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I. Introduction

Analysis of air quality conditions is required by various entities for transportation projects throughout the State of Utah. Until this time, however, there has been little guidance for project managers in terms of defining the relationship between NEPA and transportation conformity and the application of the requirements of each.

This manual is intended to offer guidance to transportation project managers and design staff to navigate the air quality analysis process and to provide the necessary information to determine precisely what level of analysis is required. Additionally, a "how to" manual and the information needed to run the CAL3QHC air quality analysis model is offered in a supplemental companion document.

Included here is an introductory discussion of the pollutants of concern, followed by a summary of the air quality implications of the National Environmental Policy Act and transportation conformity requirements. Each of these sets of regulations is discussed with respect to both regional and project level analysis. Finally, a step-by-step guide to addressing the various pollutants in an environmental document is given, including example statements for each pollutant.

2. Pollutants

The Environmental Protection Agency (EPA) has identified six criteria pollutants for which specific standards have been determined, the National Ambient Air Quality Standards (NAAQS). These six criteria pollutants are:

- particulate matter
- carbon monoxide
- ozone
- nitrogen dioxide
- sulfur dioxide
- lead

The three pollutants that are most directly attributable to motor vehicles and are of most concern in the transportation planning and environmental permitting process in Utah are carbon monoxide (CO), particulate matter (PM_{10}), and ozone (O_3).

Areas with pollutant levels above the National Ambient Air Quality Standards are called non-attainment areas. Non-attainment areas must produce a plan for reducing pollutants so that they are at or below the National Ambient Air Quality Standards. These plans are called State Implementation Plans (SIPs) and in Utah, are developed by the State of Utah Division of Air Quality. Maintenance areas are those areas that were formerly non-attainment areas for a criteria pollutant but have since met EPA standards and have a maintenance plan to stay within the standards approved by the EPA pursuant to 40 CFR 51.110 (July 1993).

Table 1 identifies each area in Utah that is currently either a non-attainment or maintenance area and for which criteria pollutant. The Utah Department of Environmental Quality, Division of Air Quality should be contacted for updates to the non-attainment or maintenance status of each pollutant.

Air quality analysis occurs at two levels: regional level analysis and project level analysis. Regional level analysis is concerned with regional air quality conformity and the project's Long Range Plan and Transportation Improvement Program status. Project level analysis is the estimation of air quality impacts of a specific transportation project, and the project's impact on a pollutant's level with respect to the NAAQS, i.e. if a project will cause a new NAAQS violation or worsen an existing violation of the standard.

Table 1: Maintenance and Non-Attainment Areas in Utah

Area	Pollutant	Metropolitan Planning Organization
Salt Lake County	PM_{10}	Wasatch Front Regional Council
Salt Lake County	Ozone	Wasatch Front Regional Council
Davis County	Ozone	Wasatch Front Regional Council
Utah County	PM_{10}	Mountainland Association of Governments
Ogden City	PM_{10}	Wasatch Front Regional Council
Ogden City	Carbon Monoxide	Wasatch Front Regional Council
Salt Lake City	Carbon Monoxide	Wasatch Front Regional Council
Provo City	Carbon Monoxide	Mountainland Association of Governments

Non-attainment or Maintenance Areas as of September 2002.

2.1 Carbon Monoxide

Carbon monoxide is of concern in the transportation planning process as motor vehicles account for a large majority of carbon monoxide emissions. It tends to be more of a problem in cold temperatures and is a product of incomplete combustion. Poorly functioning intersections have higher levels of carbon monoxide as cars move more slowly and idle for longer periods of time. Carbon monoxide is very localized in nature, tends to disperse quickly, and is the primary pollutant of concern at the local project level. The one-hour and eight-hour National Ambient Air Quality Standard for carbon monoxide is 35.0 parts per million and 9.0 ppm, respectively.

The Clean Air Act states that a transportation project cannot cause an exceedance of the NAAQS, and that a project cannot worsen an already-existing exceedance. However, a project might have positive impacts on an existing exceedance, decreasing the level of carbon monoxide, but still be above the NAAQS. Under these conditions, projects can move forward. The EPA has approved a project-level modeling technique for carbon monoxide, CAL3QHC. This process is discussed in more detail in a companion document.

2.2 Particulate Matter

Particulate Matter, or PM, is the term commonly used for dust, dirt, and smoke in the air, and can be either particles large enough to be seen by the human eye, or small enough to only be seen with an electron microscope. At this time, particles of concern are those less than ten micrometers in diameter, and so is usually referred to as PM_{10}. Sources of PM_{10} include direct sources such as diesel exhaust, construction activities, gravel pits, re-entrained road dust and unpaved roads. Indirect sources are chemical reactions from the gases of burning fuels interacting with each other and water vapor to form particles. Motor vehicles are a key source of these gases.

PM_{10} is of particular concern during the winter months, when temperature inversions trap air in mountain valleys, preventing pollutants from dispersing. Instead, particulate matter and other pollutants continue to accumulate, further compromising air quality. The longer the inversion lasts, the worse the air quality will be.

Localized impacts of PM_{10} may be serious enough in some areas so that project level conformity is required. While there is no EPA approved quantitative model for localized PM_{10}, a qualitative discussion of the current and future conditions is required in a project-level air quality analysis.

Particulate Matter 2.5 is similar to PM_{10} but with size of less than 2.5 micrometers in diameter. The annual and 24-hour standards for $PM_{2.5}$ are 15 and 65 micrograms per cubic meter respectively. In the last three years, several areas have been monitoring $PM_{2.5}$ concentrations in order to help determine at what level the pollutant needs to be addressed: regionally, locally, or both. It has been anticipated that the EPA will designate non-attainment areas, based on these three years of monitoring data, that do not meet the new $PM_{2.5}$ standards.

2.3 Ozone

Ozone is a key ingredient of summertime smog and results from a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) with the presence of heat and sunlight. These pollutants necessary to produce ozone are called precursors. Whether ozone is "good" or "bad" depends on where in the atmosphere it occurs. Ozone in the stratosphere, 10-30 miles from earth, is "good" ozone and helps to protect us from the sun's rays. "Bad" ozone is that which occurs at ground level.

Ozone is considered a summertime pollutant as heat and light are necessary to cause the chemical reaction. Vehicle exhaust is a key source of NOx and VOC. While ozone pollution is generally considered an urban pollutant, rural areas can be affected by ozone pollution as well as it can be carried long distances by wind. Along the Wasatch Front, ozone is transported by up-slope and down-slope winds mixing the necessary precursors and carrying them to other areas.

Attempts to reduce ozone and its impacts need to be done at a regional level through such things as reducing vehicle miles of travel, offering cleaner burning cars, reducing industrial emissions, capturing refueling emissions, etc. Because ozone is a regional-level pollutant, there are no project-level conformity requirements for ozone.

2.4 Other NAAQS Pollutants

The remaining three criteria pollutants, sulfur dioxide, nitrogen dioxide, and lead, are not currently pollutants of concern in Utah and therefore there are no project-level conformity requirements.

2.5 Urban Air Toxins

In addition to the NAAQS set forth by EPA for the six criteria pollutants, EPA has also established a list of 33 urban air toxics. Urban air toxics, also known as hazardous air pollutants, are those pollutants that cause or may cause cancer or other serious health effects or adverse environmental and ecological effects. Most air toxics originate from human-made sources, including road mobile sources (e.g. cars, trucks, buses), non-road mobile sources (e.g. airplanes, lawnmowers, etc.) and stationary sources (e.g. factories, refineries, power-plants), as well as indoor sources (e.g. building materials). Some air toxics are also released from natural sources such as volcanic eruptions and forest fires.

These pollutants are in the atmosphere as a result of an industrialized society. Science has been providing more evidence regarding the risks they pose to human health. The health risks for people exposed to urban air toxics at sufficiently high concentrations or lengthy durations include an increased risk of getting cancer or experiencing other serious health effects. These health effects can include damage to the immune system as well as neurological, reproductive, developmental, respiratory and other health problems.

To better understand the harmful effects that urban air toxics have on human health, the EPA developed a list of 22 mobile source air toxics (MSAT) including acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein and 1,3-butadiene. They then assessed the risks of various kinds of exposures to these pollutants. In July 1999, the EPA published a strategy to reduce urban air toxics. In March 2001, the EPA issued regulations for the producers of urban air toxics to decrease the amounts of these pollutants by target dates in 2007 and 2020. Under these regulations, between 1990 and 2020, on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde will be reduced by 67 to 76 percent, and on-highway diesel particulate matter emissions will be reduced by 90 percent. These reductions are due to the impacts of national mobile source control programs including the reformulated gasoline program, a new cap on the toxics content of gasoline, the national low emission vehicle standards, the Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and the heavy-duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. These are net emission reductions, that is, the reductions that will be experienced even after growth in VMT is taken into account.

The EPA has not yet determined how best to evaluate the impact of future roads and intersections on the ambient concentrations of urban air toxics. There are no standards for MSATs and there are no tools to determine the significance of localized concentrations or of increases or decreases in emissions. Without the necessary standards and tools, the specific impacts of a project cannot be analyzed in any meaningful way.

2.6 Greenhouse Gases

Greenhouse gases are both naturally occurring as well as by-products of human activities. They contribute to the degradation of the environment by trapping reflected heat in the atmosphere that would otherwise pass through. Industrialization and the burning of fossil fuels are the primary reasons for increased emissions of greenhouse gases. Motor vehicles are a large producer of greenhouse gases, as the burning of petroleum fuels is a primary producer of carbon dioxide, a greenhouse gas. There are no National Ambient Air Quality Standards for greenhouse gases and no regional or project-level conformity requirements associated with greenhouse gases.

3. National Environmental Policy Act Overview

The National Environmental Policy Act (NEPA) was enacted in 1970 and provides a framework through which to analyze information for decision-making that appropriately addresses environmental impacts. The NEPA process is one of evaluation of alternatives, covering a broad scope of evaluation criteria including economic, social, and environmental factors.

There is a hierarchy of laws, regulations, and guidance that provide direction for air quality analysis specific to transportation projects. First and most broadly, NEPA is a relatively short and undetailed document that directs federal agencies to consider various alternatives and their impact on the environment in their decision-making process. An important provision of NEPA is the creation of the Council on Environmental Quality (CEQ) within the Executive Office of the President. The CEQ has further defined detailed NEPA regulations in 40 CFR parts 1500-1508. 23 CFR 771 prescribes the policies and procedures for the Federal Highway Administration (FHWA) and the Urban Mass Transit Administration (UMTA) for implementing NEPA. In addition to these laws and regulations, each agency has issued guidance that offers information on how best to fulfill the intent of NEPA. Both the FHWA and the Federal Transit Administration (FTA) have issued such guidance: *Guidance for Preparing and Processing Environmental and Section 4(F) Documents, T 6640.8A* (FHWA*)* and *Guidelines for Preparing Environmental Assessments, UMTA C 5620.1* (FTA).

NEPA documents are categorized into two basic classifications: categorical exclusions (often referred to as "cat-exs") and environmental impact statements (EIS). These two processes imply degree of affect on the environment and level of analysis, with an EIS being done for projects of greater scope and significant impact. As a point of practice, there is a third NEPA document, an environmental assessment (EA), which is often prepared to assess the environmental impacts of a project. The end-product of an environmental assessment is either the preparation of an EIS if the impacts are found to be significant, or a Finding of No Significant Impact (FONSI).

The purpose of the environmental document for transportation projects is to provide full disclosure of the potential environmental impacts of the range of alternatives. Air quality is only one of many environmental factors that should be addressed. These factors must be addressed for all reasonable alternatives. The level of detail of the air quality analysis should be proportionate to the complexity, controversy, and potential impacts of the project. In addition, each alternative must generally be addressed at a consistent level in order to allow for full disclosure and informed decision-making.

Guidance written to assist in preparing environmental documents suggests that an environmental document should include a discussion of general air quality concerns in the study area, as well as both a "mesoscale" (regional) and "microscale" (local) analysis of the project and project location.

3.1 Mesoscale Requirements

In the NEPA guidance issued by the FHWA, "mesoscale" analysis refers to regional scale examination. Generally, a conformity determination is the heart of regional level analysis. For regional conformity purposes, a project is said to conform if it is included as a project in a conforming Long Range Plan and Transportation Improvement Program, and that the project has not changed in scope or design. NEPA requires that a regional conformity determination be made, but it is typically beyond the scope of project-level NEPA analysis to perform regional conformity analysis. This is usually done by the area's MPO on an annual basis.

If project is located is a non-attainment or maintenance area for any pollutant, the State Implementation Plan (SIP) should be referenced. Emissions inventories for each pollutant are included in the SIP, and the project's estimated emissions of each pollutant should be discussed in the context of emissions inventories and emissions budgets. In Utah, the only pollutants for which there are non-attainment or maintenance areas are carbon monoxide, ozone, and particulate matter.

Additional discussion of project impacts on regional air pollution levels may also be appropriate beyond a simple conformity statement.

3.2 Microscale Requirements

"Microscale" requirements are those concerned with project level analysis. NEPA analysis is concerned with project-specific issues and the impact that the project will have on the environment, so disclosure of project impacts is required. Project level air quality analyses deal mostly with localized carbon monoxide and PM_{10} emissions from the project. With respect to air quality, the primary purpose of NEPA's project level requirements are to state with certainty that:

- the project being analyzed will not create an exceedance of the NAAQS,
- the project will not worsen an existing violation, and
- the project will not delay attainment of the NAAQS if in a non-attainment or maintenance area.

These are the requirements as given in the Clean Air Act, Section 176(c).

The project-level responsibility of the NEPA document becomes proving that the project in question will not do any of the above. For carbon monoxide, there are four ways to prove that the project will not create or worsen an existing violation or delay attainment:

- Projects similar in scope that have been previously analyzed, available through "clearinghouse" (see below),
- Existing and future level of service that is better than D,
- Future traffic volumes that are less than ___ (see *Screening Tools for CO Hot Spot Analysis*), based on screening analysis done by UDOT (although this currently only applies if the project is in an attainment area), and
- CAL3QHC modeling.

A brief statement describing the justification for the judgement is sufficient if any of the above apply. It is anticipated that a transportation projects clearinghouse be created with the specific intent of maintaining an exhaustive library of previous environmental documents for transportation projects. The air quality analysis that was done for these previous environmental documents can be used for comparison purposes, and possibly as a basis for proving that carbon monoxide standards will not be exceeded. Similarities of the two projects will need to be demonstrated.

There is no approved quantitative analysis for PM_{10} but guidance is given on how to do a qualitative assessment. A clearinghouse for previously accepted PM_{10} analyses would be useful for comparing new projects to past projects that have been found to result in acceptable PM_{10} concentrations. More detailed information on qualitative PM_{10} analysis and each of the above "screening tools" is included later in this document.

Additional information generally requested by the Environmental Protection Agency (EPA) in an environmental document include a summary table of corridor-level emissions estimates for existing conditions, no build, and build alternatives. Also, a meteorological data consisting of a wind rose, which is a definition of the dominant transport direction of the winds for a location, or a qualitative description of the prevailing wind direction in the affected environment should be included in the environmental document.

4. Transportation Conformity Overview

Requirements for transportation conformity overlap the requirements for the National Environmental Policy Act. Transportation conformity is required as part of the Clean Air Act Amendments of 1990 and the Transportation Equity Act for the 21st Century. The regulations for transportation conformity are described in 40 CFR Parts 51 and 93. In general, the Transportation Conformity Rule is only applicable in non-attainment or maintenance areas.

Transportation Conformity applies to transportation plans, transportation funding programs, and transportation projects in each non-attainment or maintenance area. Conformity of transportation plans and programs is typically determined by the local Metropolitan Planning Organization.

4.1 Detailed Transportation Conformity Rules

The Transportation Conformity rule identifies specific rule references that can be followed as guidelines to specific conformity actions. Table 2 briefly introduces the requirements of the Transportation Conformity Rule. Table 2 is taken primarily from the Transportation Conformity Rule with the final column, Application to NEPA, added for the purpose of this manual. The application to NEPA is the primary purpose of this manual, as MPOs and others involved in Transportation Conformity typically understand their role, while project sponsors and their consultants are focused on NEPA approval.

Table 2: Transportation Conformity Criteria

Action	Regulation	Description	Application to NEPA
All actions at all times:	§93.110	Latest Planning Assumptions	Project Specific Information
	§93.111	Latest Emissions Model	Current emissions factors should be used in hot spot analysis
	§93.112	Consultation	Seek review (not approval) with UDOT, MPO, DAQ
Transportation Plan	§93.113(c)	Transportation Control Measures	MPO must demonstrate Plan Conformity prior to NEPA approval
	§93.118 or	Emissions Budget or	
	§93.119	Emissions Reduction	
Transportation Improvement Program (TIP)	§93.113(d)	Transportation Control Measures	MPO must demonstrate TIP Conformity prior to NEPA approval
	§93.118 or	Emissions Budget or	
	§93.119	Emissions Reduction	
Project (from a conforming plan and TIP)	§93.114	Currently conforming Plan and TIP	MPO must demonstrate Plan and TIP Conformity prior to NEPA approval and project scope must be same as approved Plan and TIP
	§93.115	Project from a conforming plan and TIP.	
	§93.116	CO and PM_{10} hot spots	Hot Spot analysis necessary
	§93.117	PM_{10} control measures	Commitment to DAQ dust control measures
Project (not from a conforming plan and TIP)	§93.113(d)	Transportation Control Measures	New regional analysis necessary
	§93.114	Currently conforming Plan and TIP	Project scope changes coordinate with MPO to update Plan and TIP
	§93.116	CO and PM_{10} hot spots	Hot Spot analysis necessary (if regional analysis possible)
	§93.117	PM_{10} control measures	Commitment to DAQ dust control measures (if regional analysis possible)
	§93.118 or	Emissions Budget or	New regional analysis necessary
	§93.119	Emissions Reduction	

4.2 Regional Conformity Analysis

Regional conformity analysis is required for a project's inclusion in a conforming Long Range Plan (LRP) and Transportation Improvement Program (TIP). This analysis is performed by the MPO.

If regional conformity has not been done by the MPO, it is possible that NEPA approval cannot proceed. If the project scope has changed as a result of the NEPA analysis, the MPO may be required to re-analyze regional conformity for both the LRP and the TIP before the project can receive NEPA approval. Once a project is included in a conforming LRP and a conforming TIP, it has met the requirements for regional conformity analysis but it must also meet the requirements for project level conformity analysis.

4.3 Project Level Conformity Analysis

The terms "project level conformity," "localized conformity," and "hot spot analysis" are used synonymously for the purpose of this section of the manual and are all used in the Transportation Conformity Regulations. In the broader sense, hot spot analysis is also used to describe the requirements for project level air quality analysis outlined in the NEPA guidance.

Generally, project level conformity only applies in carbon monoxide and PM_{10} non-attainment and maintenance areas. Localized conformity is granted if a project does not cause or contribute to any new localized carbon monoxide or PM_{10} violations or increase the frequency or severity of existing carbon monoxide or PM_{10} violations in carbon monoxide or PM_{10} non-attainment and maintenance areas. Both the consultation requirements (§93.105(c)) and the methodology requirements (§93.123) apply in the demonstration of localized conformity. Consultation requirements generally involve notifying the State Division of Air Quality, UDOT, and the local MPO (Wasatch Front Regional Council or Mountainland Association of Governments) of proposed projects either in or affecting carbon monoxide or PM_{10} non-attainment or maintenance areas.

Carbon monoxide and PM_{10} are project-specific pollutants, although PM_{10} on the Wasatch Front tends to be of a composition that is regional in nature as well. While carbon monoxide can be analyzed using EPA-approved air quality modeling processes, there is no approved quantitative modeling for PM_{10}, although FHWA guidance has been given in providing a qualitative assessment.

Carbon monoxide and PM_{10} hot-spot analyses are not required to consider construction-related activities which cause temporary increases in emissions if construction activity emissions are not identified as an emission source in the SIP. Temporary increases are defined as those which occur only during the construction phase and last five years or less at any individual site. However, project level mitigation and control measures of the applicable State Implementation Plan, or other State regulations, still apply to each individual project. In Utah, dust control procedures are identified as part of the Utah Division of Air Quality permitting requirements for applicable construction permitting.

4.3.1 Carbon Monoxide Localized Conformity Requirements

Figure 1 illustrates the analysis process for carbon monoxide at the local level for transportation projects. "Projects," at its most general level, include any capacity increasing transportation project, as increased traffic capacity leads to increased traffic volume, the primary component of increased emissions.

Methodology requirements of localized carbon monoxide conformity generally require the use of the CAL3QHC model (presently required under 40 CFR Part 51, Appendix W [Guideline on Air Quality Models]) if any of the following factors apply:

- The project is in or directly affects the CO non-attainment area;
- The project affects intersections operating or projected to operate at LOS D, E, or F; or
- The project affects one or more of the top three intersections identified in the non-attainment or maintenance area with respect to highest traffic volume or worst level of service.

In addition, a quantitative analysis should be done on mainline corridors when additional through-lanes are proposed as part of the project alternative. Intersections will always have higher concentrations of pollutants due to queue lengths and cross-street traffic volumes. However, if mainline traffic volumes increase at points that are not in close proximity to intersections, corridor pollutant levels should be analyzed as well. This should apply to all corridors including freeways.

If none of the conditions described in the "NEPA: Project Level Requirements" section are able to predict carbon monoxide levels below the NAAQS standard, then a quantitative microscale CO analysis must be performed, using the EPA approved air quality model CAL3QHC. A detailed description of how to use CAL3QHC is included as part of this document.

Localized carbon monoxide conformity may be demonstrated for cases other than those identified above using alternative quantitative practices that represent "reasonable and common professional practice" or using qualitative considerations of local factors.

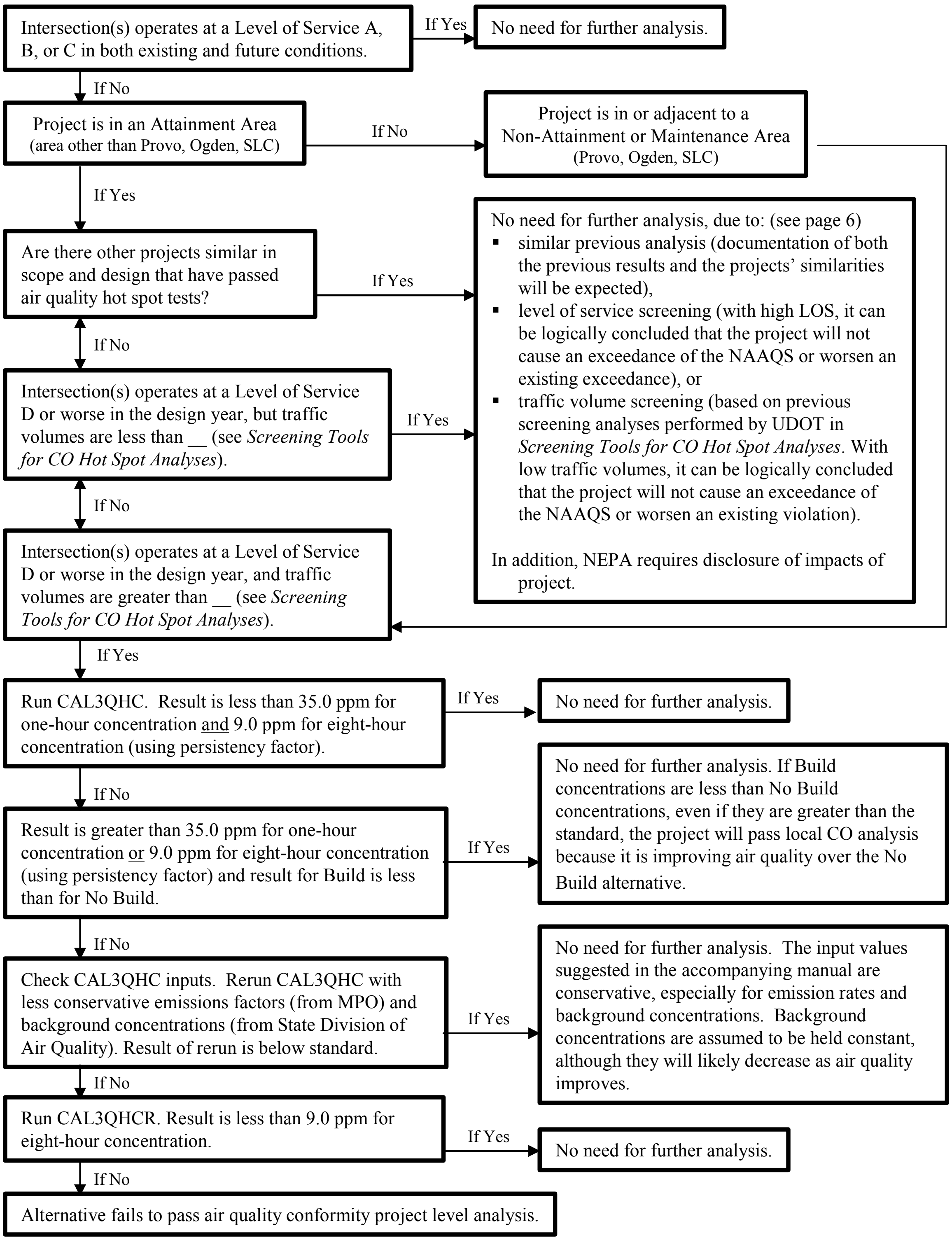
CAL3QHCR is a revised and enhanced version of CAL3QHC that can process up to one year of hourly meteorological data and emissions, traffic, and signalization information for each hour of a week. It looks at the fluctuation in traffic volumes and air movement throughout the day, and gives a more accurate eight-hour concentration than does CAL3QHC.

CAL3QHC is basically a screening tool that identifies potential exceedances of the carbon monoxide standard. The "R" version offers a refined analysis of future conditions using meteorological data rather than "worst case scenario" conditions. The EPA requires, as input data for CAL3QHCR, the use of five years of data from the nearest airport or one year of on-site data. Due to the intensity of data required to run this model accurately, the use of CAL3QHCR has not been endorsed by the FHWA.

4.3.2 PM_{10} Localized Conformity Requirements

The transportation conformity rule says that in a PM_{10} non-attainment or maintenance area, a project-level conformity determination must document that no new violations will be created by the project, and that the project will not increase the severity or frequency of any existing violations. However, unlike carbon monoxide, the EPA has not issued hot-spot modeling guidance for PM_{10} hot spots. Until such guidance is issued and announced in the federal register, qualitative analysis of local conditions is the standard procedure for particulate matter hot spot analysis.

Figure 1: Localized Carbon Monoxide Conformity Analysis Process



A project-level conformity determination for PM_{10} is based on qualitative, versus quantitative, analysis. A detailed portrayal of existing conditions, the project characteristics that influence PM_{10} levels, and an analysis of how conditions are expected to change over time are the fundamentals of the qualitative analysis.

Factors to be considered describing existing PM_{10} conditions include:

- Area affected by the proposed project including a geographic description and general air quality conditions that might be influenced by the project.
- Existing conditions including:
  - Air quality monitoring station data.
  - Traffic conditions including volumes, speed, congestion, etc.
  - Built and natural environment such as urban or rural, physical barriers to the dispersion of PM_{10}, etc.
  - Meteorology, climate and seasonal data such as atmospheric inversions, prevailing wind information, etc.
  - Transportation control measures that may mitigate PM_{10} emissions.
  - Other factors as appropriate.

Transportation projects that meet all of the following conditions are subject to PM_{10} qualitative hot-spot analysis:

- Within a PM_{10} non-attainment or maintenance area;
- Funded or approved by the FHWA or FTA;
- Is not an "exempt project" or a traffic signal synchronization project (see Appendix A); and
- Propose increasing the number of travel lanes.

The roles for various agencies are explicitly defined in guidance documents:

1. The project sponsor is responsible for providing the PM_{10} qualitative assessment and meeting the consultation requirements of 40 CFR. The project sponsor is also responsible for conducting the environmental analysis as required by NEPA.

2. FHWA and FTA are to determine that conformity requirements are met. This generally occurs through the interagency consultation process. NEPA documents are used to determine that the qualitative analysis has been properly conducted.

3. The EPA is an advisory body in the PM_{10} conformity process. FHWA and FTA usually consult with the EPA before making a conformity determination.

In Utah, PM_{10} is generally considered a regional issue. Automobiles are substantial contributors to this issue through tailpipe emissions of nitrogen oxides, which are generally decreasing due to national automobile controls, and fugitive dust, which is believed to be increasing in proportion to the growth in vehicle miles traveled (VMT). A project's contributions of PM_{10} emissions to NOx and fugitive dust concentrations is generally included in the regional conformity analysis done by the MPO. Project level contribution analysis can be done by comparing total intersection or roadway traffic volumes to other intersections or roads in the area. In addition, diesel emissions from trucks can also be analyzed by comparing the truck percentage of the proposed project to other locations.

The specific qualitative guidelines for PM_{10} are given in Appendix B.

5. Air Quality Analysis Document Preparation

The preceding information in this document is intended to help distinguish between NEPA requirements and conformity requirements with respect to air quality analysis. Unfortunately, the distinction between the two is rarely black and white.

Table 3 shows each criteria pollutant and the entire state of Utah divided by non-attainment and attainment areas. Indicated in the table is a reference to an example statement for each criteria pollutant based on project geography. These statements are intended to offer examples of specific wording for each pollutant for use in environmental documents. They are intended to assist in writing environmental documents, and may need to be modified to reflect the circumstances of specific projects.

Table 3: Statements by Pollutant and Attainment/Non-Attainment Area

If the project is…		In Utah County, but not in Provo	In Provo City	In Salt Lake County, but not in Salt Lake City	In Salt Lake City	Any-where in Davis County	In Ogden City	In any other Utah loca-tion
Particulate Matter	Regional	A	A	A	A	B	A	B
	Project	D	D	D	D	C	D	C
Carbon Monoxide	Regional	E	F	E	F	E	F	E
	Project	H	G	H	G	H	G	H
Ozone	Regional	J	J	I	I	I	J	J
	Project	K	K	K	K	K	K	K
Nitrogen Dioxide	Regional / Project	L	L	L	L	L	L	L
Sulfur Dioxide	Regional / Project	L	L	L	L	L	L	L
Lead	Regional / Project	L	L	L	L	L	L	L
Other Pollutants	Regional / Project	M	M	M	M	M	M	M

5.1 Particulate Matter

Statement A: Regional PM_{10} analysis – Non-Attainment Area

> "This project is located in (Utah/Salt Lake County or Ogden City) and so is in a non-attainment area for particulate matter. The SIP was approved by the EPA on (date). The FHWA has determined that both the region's long range transportation plan and the transportation improvement program conform to the SIP. The FHWA has determined that this project is included in the transportation improvement program for the (WFRC/MAG) area. Therefore, pursuant to 23 CFR 770, this project conforms to the SIP."

Statement B: Regional PM_{10} analysis – Attainment Area

"This project is located in an area that is not a non-attainment or maintenance area for PM_{10} according to the Environmental Protection Agency and there is no requirement for further regional analysis of PM_{10}. In Utah, PM_{10} has a strong regional component to it. Utah's climate and geography contribute to PM_{10}'s regional impacts, when temperature inversions cause particles to become trapped in mountainous valleys. Meteorological conditions combined with changes in the regional land use and transportation patterns might affect PM_{10} at a regional level. However, the effects of any individual project are likely to be small and uncertain."

Statement C: Localized PM_{10} analysis – Attainment Area

"This project is located in (county other than Utah or Salt Lake, city other than Odgen) and so is not located in an EPA-designated non-attainment or maintenance area for PM_{10}. While there is no requirement for additional PM_{10} hot spot analysis, included here is a discussion of future conditions, including thoughtful consideration of factors such as possible future land uses like gravel pits, future construction projects, change in traffic patterns and volumes, street sanding and sweeping, and changing meteorological conditions."

Statement D: Localized PM_{10} analysis – Non-Attainment Area

"PM_{10} currently has no EPA-approved quantitative method of hot spot analysis. In its absence, a qualitative analysis is presented. PM_{10} concentrations are related to a combination of direct PM_{10} sources such as fugitive dust that comes from increased vehicle miles of travel, and secondary reactions of NOx and SOx which form PM_{10} in the atmosphere. It is believed that traffic volumes and corresponding level of service have less impact on PM_{10} concentrations than the larger regional trends in the emission rates and industrial controls. Therefore, it can be expected that PM_{10} in ____ County will remain a regional issue related to prolonged temperature inversions and a gradual build-up of PM_{10}-related pollutants and will not be created by local PM_{10} concentrations of any intersection on (project name/location)."

The above paragraph should be followed by additional qualitative discussion related to PM_{10} which might include discussions of nearby gravel pits, construction projects, meteorological conditions, changes in traffic patterns and volumes, street sanding and sweeping, and changing meteorological conditions, among others.

5.2 Carbon Monoxide

Statement E: Regional carbon monoxide analysis – Attainment Area

"This project is located in (city other than Ogden, Salt Lake, and Provo) and so is not a non-attainment or maintenance area for carbon monoxide according to the

Environmental Protection Agency. Although further analysis is not necessary, it is worth mentioning some of the regional components of carbon monoxide. While a vast majority of carbon monoxide can be attributed to motor vehicles, industrial processes such as metals processing, forest fires, wood stoves, and even cigarette smoke are additional sources of CO emissions. Significant changes in other emissions sources combined with changes in travel patterns and transportation networks might affect carbon monoxide at a regional level. However, the effects of any individual project are likely to be small and uncertain."

Statement F: Regional carbon monoxide analysis – Non-Attainment Area

"This project is located in (Salt Lake/Provo/Ogden City) and so is in a non-attainment area for carbon monoxide. The SIP was approved by the Environmental Protection Agency (EPA) on (date). The FHWA has determined that both the region's transportation plan and the transportation improvement program conform to the SIP. The FHWA has determined that this project is included in the transportation improvement program for (WFRC/MAG). Therefore, pursuant to 23 CFR 770, this project conforms to the SIP."

Statement G: Localized carbon monoxide analysis – Non-Attainment Area

"This project is located in (Salt Lake/Provo/Ogden City) and so is in a non-attainment area for carbon monoxide. According to 40 CFR Part 51 Appendix W, CAL3QHC is required when project intersections are expected to function at level of service D or worse. Based on traffic analysis of the project area using (*Highway Capacity Software* or similar traffic software), the future level of service for the (project name) is projected to be (A, B, or C). Therefore, no further localized carbon monoxide analysis is necessary."

Or

"This project is located in (Salt Lake/Provo/Ogden City) and so is in a non-attainment area for carbon monoxide. Based on traffic analysis of future conditions, level of service for (project name) is expected to be (D, E, or F). CAL3QHC analysis showed future carbon monoxide concentrations to be (number less than 35.0 parts per million) for the one-hour standard and (number less than 9.0 parts per million) for the eight-hour standard, which are below the National Ambient Air Quality Standard for carbon monoxide."

Or

"This project is located in (Salt Lake/Provo/Ogden City) and so is in a non-attainment area for carbon monoxide. Additional travel lanes are included in the scope of this project, and per the guidance of the Utah Department of Transportation, CAL3QHC analysis was done. This analysis showed future carbon monoxide concentrations to be (number less than 35.0 parts per million) for the one-hour standard and (number less than 9.0 parts per million) for the eight-hour standard, which are below the National Ambient Air Quality Standard for carbon monoxide."

Statement H: Localized carbon monoxide analysis – Attainment Area

"This project is located in (city other than Ogden, Salt Lake, and Provo) which is not a non-attainment or maintenance area for carbon monoxide. While there is no requirement for additional carbon monoxide hot spot analysis under transportation conformity rules, NEPA requirements still apply; proving with reasonable certainty that (project name) will not cause an exceedance. For (project name), that verification comes from the analysis done with respect to (traffic volume screening/previous analysis of project similar in scope/level of service screening/CAL3QHC analysis)."

Continue to the following appropriate discussion:

Traffic Volume Screening
"Based on exhaustive sensitivity testing done for the Utah Department of Transportation for this Air Quality Hotspot Manual, it has been determined that traffic volumes in the range of ____ do not cause carbon monoxide levels to increase to the point of violating the NAAQS one-hour or eight-hour standards. This project's anticipated future volumes are (traffic volume), so no violation of the standard is anticipated."

Or

Previous Analysis of Projects Similar in Scope
"Based on the previous analysis of (previous project name), which is similar in scope and nature to (project name), where no future violations of the NAAQS were expected, it can be reasonably expected that this project will not create new exceedances, worsen existing exceedances, or delay attainment of a non-attainment area. CAL3QHC modeling predicted carbon monoxide concentrations at ___ and ___ (numbers less than 35.0 and 9.0) for the one-hour and eight-hour standards, respectively." Further description of similarities of the two projects may be warranted.

Or

Level of Service Screening
"Based on traffic analysis of the project area using (*Highway Capacity Software* or similar traffic software, the future level of service for the (project name) is projected to be (A, B, or C). According to 40 CFR Part 51 Appendix W, CAL3QHC is required when project intersections are expected to function at level of service D or worse."

Or

CAL3QHC Analysis

"CAL3QHC analysis showed future carbon monoxide concentrations to be (number less than 35.0 parts per million) for the one-hour standard and (number less than 9.0 parts per million) for the eight-hour standard, which are below the National Ambient Air Quality Standard for carbon monoxide."

For projects where additional travel lanes are included in scope:
"This project is located in (city other than Salt Lake/Provo/Ogden City) and so is not in a non-attainment area for carbon monoxide. However, additional travel lanes are included in the scope of this project, and per the guidance of the Utah Department of Transportation, CAL3QHC analysis was done. This analysis showed future carbon monoxide concentrations to be (number less than 35.0 parts per million) for the one-hour standard and (number less than 9.0 parts per million) for the eight-hour standard, which are below the National Ambient Air Quality Standard for carbon monoxide."

5.3 Ozone

Statement I: Regional level ozone analysis – Non-Attainment Area

"This project is located in (Salt Lake/Davis County) and so is in a non-attainment area for ozone. The SIP was approved by the Environmental Protection Agency (EPA) on (date). The FHWA has determined that both the region's transportation plan and the transportation improvement program conform to the SIP. The FHWA has determined that this project is included in the transportation improvement program for (WFRC/MAG). Therefore, pursuant to 23 CFR 770, this project conforms to the SIP."

Statement J: Regional ozone analysis – Attainment Area

"This project is located in (county other than Salt Lake or Davis) and so is not a non-attainment or maintenance area for ozone according to the Environmental Protection Agency. Although further analysis is not necessary, a short discussion of the regional nature of ozone is warranted. Ozone is the result of a chemical reaction between oxides of nitrogen, volatile organic compounds, and heat and sunlight. Vehicle exhaust, industrial emissions, and gasoline vapors are major sources of oxides of nitrogen and volatile organic compounds. Meteorological conditions combined with changes in the regional land use and transportation patterns might affect ozone at a regional level. However, the effects of any individual project are likely to be small and uncertain."

Statement K: Localized ozone analysis – All areas

"Ozone is a regional pollutant and is not able to be analyzed at the project level. While no further analysis of project-level ozone is necessary, it is important to mention that the Wasatch Front region does have ozone-related issues, especially Salt Lake and Davis Counties which are non-attainment areas for ozone. Ozone is formed at a regional level, and so is a complex and regional problem that is unlikely to be negatively affected by (project name). In fact, if (project name) reduces traffic congestion and delay, it may actually improve the region's ozone problems, although project-level improvements are likely to impact ozone minimally."

5.4 Nitrogen Dioxide, Sulfur Dioxide, and Lead

Statement L: Nitrogen dioxide, sulfur dioxide, and lead analysis – All Areas

"Other criteria pollutants include nitrogen dioxide, sulfur dioxide, and lead. There are currently no non-attainment or maintenance areas in Utah for any of these pollutants. Due to their regional nature and the minimization of motor vehicles as a source of these pollutants (especially lead), there is no reason to believe that (project name) will affect concentrations of these pollutants in the project area.

5.5 Other Pollutants including Greenhouse Gases

Statement M: Other pollutants including greenhouse gases – All Areas

"At this time, no federal laws or regulations have been enacted and the EPA has not established criteria or thresholds for greenhouse gas emissions. Because the sources and effects of greenhouse gases are global in nature, to attempt project-level analysis of negligible increases or decreases of carbon dioxide (the primary greenhouse gas transportation-related emission) is technically unfeasible. Because of high levels of uncertainty, the results of such an analysis would not be likely to inform decision-making at the project level. The scope of such an analysis, with any results being purely speculative, goes far beyond the disclosure impacts needed to make sound transportation decisions."

Appendix A:
40 CFR 93.126 - Exempt Projects

Safety

Railroad/highway crossing
Hazard elimination program
Safer non-Federal-aid system roads
Shoulder improvements
Increasing sight distance
Safety improvement program
Traffic control devices and operating assistance other than signalization projects
Railroad/highway crossing warning devices
Guardrails, median barriers, crash cushions
Pavement resurfacing and/or rehabilitation
Pavement marking demonstration
Emergency relief (23 U.S.C. 125)
Fencing
Skid treatments
Safety roadside rest areas
Adding medians
Truck climbing lanes outside the urbanized area
Lighting improvements
Widening narrow pavements or reconstructing bridges (no additional travel lanes)
Emergency truck pullovers

Mass Transit

Operating assistance to transit agencies
Purchase of support vehicles
Rehabilitation of transit vehicles
Purchase of office, shop, and operating equipment for existing facilities
Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.)
Construction or renovation of power, signal, and communications systems
Construction of small passenger shelters and information kiosks
Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures)
Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way
Purchase of new buses and rail cars to replace existing vehicles or for minor fleet expansions
Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771

Air Quality

Continuation of ride-sharing and van-pooling promotion activities at current levels
Bicycle and pedestrian facilities

Other

Specific activities which do not involve or lead directly to construction, such as:
- Planning and technical studies
- Grants for training and research programs
- Planning activities conducted pursuant to titles 23 and 49 U.S.C.
- Federal-aid systems revisions

Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action.
Noise attenuation
Emergency or hardship advance land acquisitions (23 CFR 712.204(d))
Acquisition of scenic easements
Plantings, landscaping, etc.
Sign removal
Directional and informational signs
Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities)
Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational or capacity changes
In nonattainment or maintenance areas, such projects are exempt only if they are in compliance with control measures in the applicable implementation plan.

Appendix B:
PM_{10} Qualitative Guidelines

The following information is taken directly from the Federal Highway Administration web page: www.fhwa.dot.gov/environment/conformity/hspot_a1.htm.

Summary of Guidance

This guidance, developed in coordination with EPA, attempts to fill a gap in the understanding of what analysis is required under the law and current regulation relating to particulate matter (PM) pollution from transportation sources.

It is general in nature in the form of questions and answers which address many commonly asked questions about PM. Individual areas will have their own needs and should consult with Federal, State, or local agencies that can provide them with more detailed information about transportation sources of PM and its mitigation.

The first section addresses many procedural issues such as what requirements must be met, what are the different agencies involved in PM conformity determinations and their roles, when must the analysis be performed, and other information necessary to perform a PM analysis. This document indicates that there are many agencies involved in the evaluation of PM air quality issues. The analyst needs to coordinate efforts with the other agencies having similar responsibilities.

Attached to this guidance in an appendix are several examples of qualitative PM analysis. These examples demonstrate different levels of inquiry that may be used to qualitatively consider the impacts of various projects on PM-10 levels in a given area. These examples are not the only ones available. They simply provide an overview of some relevant factors in a qualitative analysis and how they might be used.

As noted above, this guidance is not definitive for any project but guidance for all projects. This must be considered as one reads this and applies it to their location. Additional assistance is available from State and local agencies, EPA, and FHWA Resource Centers and the Headquarter's Offices.

Questions and Answers

What are the analytical requirements for assessing the impacts of projects in PM-10 nonattainment and maintenance areas?

Section 93.116 of the transportation conformity rule states that any project-level conformity determination in a PM-10 nonattainment or maintenance area (see Figure 1) must document that no new local PM-10 violations will be created and the severity or number of existing violations will not be increased as a result of the project. Since EPA has not released modeling guidance on how to perform quantitative PM-10 hot-spot analysis, such quantitative analysis is not currently required (40 CFR 93.123(b)(4)). However, if a quantitative analysis is not done, the demonstration required by 40 CFR 93.116 must be based on a qualitative consideration of local factors (40 CFR 93.123(b)(2)).

A reasoned and logical explanation of why a hot spot will not be created or worsened is to be provided for project-level conformity determinations. This guidance provides examples of how to develop a hot-spot analysis, but other methods would also be acceptable. The interagency consultation process must be used to evaluate and decide on the methods and assumptions for conducting hot-spot analysis (40 CFR 93.105(c)(1)(i)).

What projects are subject to PM-10 qualitative hot-spot analysis?

A transportation project is subject to PM-10 hot-spot qualitative analysis requirements if it is:

- within a PM-10 nonattainment or maintenance area;
- funded or approved by FHWA or FTA;
- is not a project covered by sections 93.126 and 93.128 of the transportation conformity rule; and
- a quantitative analysis has not been performed.[1]

Interagency consultation must be undertaken to identify which projects require PM-10 qualitative hot spot analyses.

What are the roles and responsibilities of different agencies in project-level conformity determinations?

Roles and responsibilities of different agencies for meeting the transportation conformity requirements are addressed in either 40 CFR 93.105 of the Federal conformity rule or in a State's EPA-approved Conformity State Implementation Plan (SIP). In general, the following agencies have these responsibilities in implementing the PM-10 hot-spot analysis requirement.

1. Project Sponsor - The project sponsor is the agency responsible for implementing the project. Typically, the project sponsor is a local government, transit operator, metropolitan planning organization, or State department of transportation. The project sponsor is responsible for providing the PM-10 qualitative analysis addressed in this guidance and meeting consultation requirements described in 40 CFR 93.105 or the approved Conformity SIP. Consultation with State and/or local agencies is critical to completing qualitative hot-spot analyses. The project sponsor, in cooperation with the Federal Agency, also is responsible for conducting the environmental analysis and review to comply with the National Environmental Policy Act (NEPA) of 1969 as required by the CEQ regulations (40 CFR 1500-1508) and the FHWA/FTA project development requirements (23 CFR Part 771).

2. FHWA/FTA - FHWA and FTA are jointly responsible for determining that the requirements of the Transportation Conformity Rule are met. The determination of whether the PM-10 project level qualitative analysis requirements have been met generally occurs through the interagency consultation process. Documents prepared to meet the requirements of NEPA (40 CFR 1500-1508) and 23 CFR Part 771 are used to demonstrate that the analysis has been appropriately conducted. These documents may include Environmental Impact Statements (EISs) with Records of Decision (RODs) and Environmental Assessments (EAs) with Findings of No Significant Impacts (FONSI). The analysis may be appropriate for Categorical Exclusions (CEs) determinations. It is the responsibility of FHWA/FTA to review and approve EISs, RODs EAs, FONSIs, and CEs for certain actions.

3. EPA - EPA plays an advisory role in the conformity determination process. As a matter of course, FHWA/FTA consult with EPA before making a final conformity determination.

What analysis years should be used in hot-spot analyses?

In the preamble of an amendment to the conformity rule published April 10, 2000, EPA clarifies its policy concerning the horizon years to be used in a hot-spot analysis (65 FR 18914). As discussed in that rulemaking, the transportation conformity rule provides areas with flexibility to decide how to demonstrate that hot-spots are not caused or worsened in an area through the interagency consultation process, as appropriate to the individual area, on a case-by-case basis. Although most areas conduct hot-spot analyses for the year of project completion, many areas also examine other analysis years in the future. For example, some areas may analyze the last year of a currently conforming transportation plan, or another year within the timeframe of that plan, whichever year emissions are expected to be the highest. In any case, the hot-spot analysis should examine the year in which peak emissions in the project area are expected, which may not necessarily be the last year of the conforming plan. For more discussion on this issue, see the preamble to the April 10, 2000, final rule (65 FR 18914).

What are the criteria for meeting project level hot-spot analysis?

The conformity rule specifies that FHWA/FTA-funded or approved projects in PM-10 nonattainment and maintenance areas must not cause or contribute to any new localized PM-10 violations or increase the frequency or severity of any existing PM-10 violations within the project's area. The hot-spot analysis is intended to assess possible violations due to the project in combination with changes in the background levels over time. If there are no current exceedances or violations in the area affected by the project, the project's future effect is compared to the standard since the test is whether the project causes a new violation (i.e., the project's effect causes an exceedance of the standard). If there are current violations or exceedances in the area affected by the project, the project cannot worsen an existing violation, so a qualitative no-build/build comparison is required at a minimum.

Hot-spot analyses must include the entire project and may be performed only after the project's major design features have been identified. Preferred project alternatives must be compared to a no-build alternative in either a conceptual or more technically rigorous way. In performing the hot spot analysis, the design concept and scope of the project must be consistent to that included in the transportation plan and transportation improvement program. Any significant change in project design or scope will require a reevaluation of regional emissions and a new qualitative hot-spot analysis. However, if there are no localized violations, and if there would not be any violations within the project area, the project clearly satisfies this criterion.

Hot-spot analyses are not required to consider temporary increases in emissions caused by construction related activities that last 5 years or less at any individual site (40 CFR 93.123 (c)(5)).

What is the definition of a new violation?

The consultation process should be used to determine if new violations are anticipated under the hot-spot analyses. As implied, a new violation is one where concentration levels are expected to be higher than the PM-10 standard in a localized area that has not previously demonstrated such levels. It can and should be distinguishable from an exceedance registered by an existing, nearby monitor that is not caused by the project. As discussed in the preamble to the November 24, 1993, conformity rule, "EPA believes that a seemingly new violation may be considered to be a relocation and reduction of an existing violation only if it were in the areas substantially affected by the project and if the predicted design value for the new site would be less than the design value at the‘old' site without the project, i.e., a net air quality benefit." (58 FR 62213).

What are some of the factors to consider in describing existing conditions?

An accurate description of existing conditions and factors that may influence PM-10 levels in the area affected by the proposed project should be provided. Analysis of those conditions, and how they are projected to change over time with the addition of the proposed project is the basis of the project-level conformity determination. Factors to be considered include:

1. Area affected by the proposed project. Describe the geographic area and general air quality conditions that could be influenced by the project, focusing specifically on PM-10 levels.

2. Existing Conditions. While the following list is not intended to be exhaustive or prescriptive, factors that are relevant to PM-10 levels may include:

   A. Air Quality. Determine if a monitoring station is near the project that will provide data on local air quality conditions, including PM-10 emissions. Also, consider reviewing data from monitoring stations located in other areas that may have similar traffic or environmental conditions.

      Source:

      i. State/local areas similar to the project area. This review may be useful to evaluate and better understand the effects of the project.

      ii. Monitoring data and modeling results included in SIP and more recent monitoring data from State/local air agencies; State/local public health departments.

   B. Transportation and traffic conditions. Address modes, volumes, speed, congestion, trends, etc. When the project analysis is incorporated in a NEPA document, this description should largely reference other sections of the NEPA document that address traffic and transportation issues in greater depth. A brief summary description of transportation and traffic conditions may be appropriate.

      Source: Project sponsor and observation.

   C. Built and natural environment, as they relate to PM-10. This description would include whether the character of the area is urban or rural, and whether adjacent buildings or topography create barriers to dispersal of PM-10. Relevant development trends and land use patterns should be addressed if they have a bearing on potential PM emissions from the project.

      Source: Project sponsor, local planning agency, and observation.

   D. Meteorology, climate and seasonal data relevant to PM-10 emissions. Address whether the area experiences atmospheric "inversions," prevailing wind direction and speed, and amount of seasonal rainfall which have an impact on the prevalence of PM concentrations.

      Source: State/local air quality agencies; National Weather Service.

E. Transportation control measures (TCMs) or adopted emission control programs in the project area that may mitigate any potential increase in PM emissions or that may be affected by the proposed project. The impact of national rules and regulations that EPA has promulgated, such as heavy-duty diesel rules, that are currently being implemented should also be considered.

   Source: State or local air agency, EPA; review the applicable PM-10 SIP.

F. Other factors as appropriate.

What factors may be considered in describing "future" scenarios for projects?

The following factors may be used to describe the "future" scenarios[2]. These factors will change in the future, including the design year for the project, and whether these would expect to result in increases or decreases in PM-10 levels. Examples of factors that may lead to changes in PM-10 levels in the project area include:

- increased traffic volumes (relate changes in vehicle miles traveled (VMT) to changes in PM-10, particularly for diesel vehicles, trucks, buses, cars, etc.);
- street sanding/sweeping practices;
- changes in diesel truck or bus routes;
- major construction projects in the area affected by the project; and
- changes in the built and natural environment which may change current PM-10 dispersal patterns.

Each future build scenarios should consider whether the project would be expected to increase or decrease PM-10 concentration levels in the project area. This analysis should address whether the build alternative(s) would be expected to result in an exceedance of the PM-10 standard, or affect existing violations. As noted before, the temporary increase in emissions resulting from construction related activities of the proposed project that last 5 years or less does not need to be considered in the hot-spot analysis.

What are the possible measures to mitigate an increase in PM-10 concentrations?

Where the project may lead to an increase in PM-10 levels, measures to mitigate these impacts should be addressed. In these cases, written commitments for project-level mitigation or control measures must be obtained from the project sponsor and/or operator prior to making a project-level conformity determination (40 CFR 93.125(a)). Options to reduce localized PM-10 emissions are included in the Appendix.

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[1] The conformity rule does not require quantitative analyses. However, if an area has conducted a quantitative analysis, a qualitative analysis does not need to be done.

[2] Future scenarios include "Future Without the Project" (the "No-Build Alternative") and "Future With the Project" ("Build Alternative(s))."

Examples of Qualitative Analysis Techniques

There are several approaches to qualitative analysis that can be used to meet the requirements of the conformity rule, the most common of which are described below. These approaches vary from a simple summary statement to more detailed analyses. The approach should be decided through consultation with all parties involved in the preparation of the analysis document, and also will be affected by the data and other resources available to the agency responsible for performing the analysis.

Information Potentially Relevant to Qualitative Analysis

As discussed, the interagency consultation process is used to determine the approach and depth of the qualitative analysis, and the outcome of that consultation should be documented. A meeting of the agencies that participate in the conformity finding including Federal, State, and local agencies should be held to discuss the best approach for any given project. It is likely that one approach may be used for one project while another approach may be more appropriate for a different project.

All analyses conducted should contain similar information regardless of the approach selected, including the project description, the factors that will influence the air quality (influence factors), and any programs that can be implemented to reduce emissions (mitigation practices) from the project.

1. Project Description

   The qualitative analysis should begin with (or reference in the appropriate section of the NEPA document) a brief description of the project including where it is located (rural, urban, suburban) and the project’s scope (adding an interchange, widening a highway, changing signal timing, etc.).

2. Influence Factors

   The "influence factors" are those elements that may influence the quality of the air near the project and can generally be categorized into the areas listed below. These are not the only factors that can influence the air quality near a project, however, these may be among the most critical elements. Elaboration of these influence factors is discussed in the following paragraphs.

3. Statement of existing air quality

   Existing air quality should be included to establish the probability of air quality problems from the project. Developers and reviewers of the analysis study should be aware of the existing conditions so that they can understand the relative impact that the project is likely to have. It may be appropriate to cite published information regarding regional or local trend data on PM-10 concentrations, when such data is available and relevant to the project.

   A. Traffic associated with the project

      Traffic information should describe current volumes and expected volumes since many projects involve adding capacity to reduce congestion while other projects add new access points. Understanding whether VMT is increasing or decreasing, or how a project would change the mix of vehicles on the road will assist in judging the project's air quality impacts. For example, increased VMT associated with a new project is an important consideration in areas with a fugitive dust problem while increased congestion may be more relevant in areas where tailpipe emissions from diesel engines are the main PM-10 source. Traffic discussions should also describe any speed changes that may result from the project since emission estimates are very sensitive to vehicle speed. The speed and volume estimating method should be included. Additionally, the "fleet" or "vehicle profile" describing the types and percentages of vehicles likely to use the project will provide important information when considering the contribution.

B. Meteorology, seasonal and climate information for area

Meteorology is a major influence on air pollution problems. Temperature, amount of precipitation, seasonal and other weather conditions are also influences that should be discussed. When performing a qualitative analysis for PM-10, care should be taken to separate the PM emissions related to windblown or fugitive dust from emissions due directly from the project.

C. Location of monitoring stations

Discussing the location of monitoring stations could also be useful since determining a project's proximity to a monitor can help establish its influence. In addition to the project, there may be other sources of PM generated near the monitor such as a power plant, airport, or bus terminal that generate emissions not directly related to the project.

D. Miscellaneous information

Miscellaneous influencing factors could be whether the area has paved or unpaved shoulders, the number of unpaved roads, and whether roads are salted or sanded during winter storm events. Care should be taken to separate on-road sources of PM emissions from other sources including agricultural fields, industrial factories, and power generation plants. Also any on-road mobile source emission control programs and TCMs that will influence the emission concentrations for the area should be discussed.

4. Mitigation Practices

In addition to describing the project's potential for creating an emission problem, the qualitative analysis process can provide a list of operational practices that could be implemented to mitigate or offset any PM problem from the project that may be found to occur at a later time. A table including a menu of options is included below, however, many others may be possible. The options list is divided into solutions based on the suspected cause of the pollution although there may be other causes and solutions that are available.

Options to Reduce Particulate Matter Pollution		
Suspected Source of PM10 Problem	**Options to Reduce PM Pollution**	
	Mitigation Measure	**Comments**
Fugitive Dust	Truck Cover Laws	may require greater enforcement effort in some areas
	Street cleaning program	includes vacuuming and flushing
	Site watering program	regular program will reduce dust
	Street and shoulder paving; Runoff and erosion control	should reduce significant quantities of dust material
Snow and Ice Control	Reduce the quantity of sand	use harder material that is not prone to grinding into finer particles or additional chemical treatments
Diesel Emissions from a Bus Terminal Expansion	Purchase a significant number of natural gas buses	cleaner buses will reduce localized PM-10 emissions for these types of transit projects
Diesel Emissions	Require PM diesel "traps" on diesel exhaust systems	traps or filters can substantially reduce PM-10 emissions; programs providing financial support available
Vehicle Emissions	Provide a "retrofit" program for older, higher emitting vehicles	could be used on bus fleets to install newer engines or technologies known to have lower emissions

Qualitative Estimation Techniques

The following list of techniques is not exhaustive and does not imply any order of priority. The specific technique used, whether one of those below or an alternative method, should be selected and documented through the interagency consultation process or through the NEPA scoping and public involvement process.

Depending on the outcome of a qualitative analysis, some areas may choose to supplement their findings with a more technical or quantitative approach that may contribute to a better understanding of the project's PM-10 effects. In any case, the interagency process should be used to determine the approach and method for analyzing the PM-10 effects of a project.

In general, qualitative methods can be categorized into the following approaches:

1. Comparison to another location with similar characteristics

   This method is probably one of the easiest approaches to demonstrating that a new project will not create a PM violation. It involves reviewing similar projects constructed in the past and built in close proximity to the proposed project. Sponsors should consult with air agencies for available information from previous work which could be used to support the new project's impact, if this work is still applicable.

2. Findings from air quality studies

   The SIP for an area contains a tremendous amount of information on air quality conditions in nonattainment and maintenance areas. This may include monitoring data and modeling data. The SIP also contains specific information on an area's air quality standards and goals. The SIP is an important tool to be referenced when conducting qualitative analyses for PM-10.

It may be possible that some organization such as a State or local air agency or a university has also performed an air quality study in the local area of the proposed project. If these studies are available, they could be cited in the documentation indicating the expected air quality impacts of the proposed project. Some examples for conducting PM-10 qualitative analysis follow.

Example A: Project Which Does Not Increase VMT

A qualitative analysis was conducted for the addition of an acceleration/deceleration lane in a PM-10 nonattainment area, and re-entrained road dust is the primary source of PM-10 emissions. VMT was not expected to increase because no capacity expansion was planned for the roadway segments on either end of the project. Because VMT would not increase, and therefore fugitive PM-10 emissions from road dust are not expected to increase, the interagency consultation team concluded that there would be no impact on PM-10 emissions or concentrations, and no further analysis was needed.

Example B: Project Which Reduces Idling Emissions

The project in question involves modification of an intersection to include continuous right turn lanes in an area where idling emissions are the primary source of PM-10 emissions. While the movement improvements at the intersection would provide a slight increase in capacity, they would also reduce overall idling time at the intersection by 25 percent. The reduction in idling time would reduce idle emissions of PM-10, thus providing an overall air quality benefit. (This may also prove true for a project that converted a signalized intersection into an interchange.)

Example C: Comparison of New Project to Similar Project in the SIP

A qualitative analysis was conducted for a new freeway interchange at the edge of the urban area. This interchange would lead to VMT increases from both additional travel on the new connecting road, and from development planned for the vicinity of the interchange.

The area in question has a PM-10 maintenance plan that includes a modeled demonstration of maintenance extending out to the year 2015. The interagency consultation team decided to evaluate the new interchange by comparing it to an existing interchange that is within the PM-10 maintenance plan's modeling domain. The team located a similar interchange that was located near the edge of the urban area, and that also had higher traffic volumes and more intensive surrounding development than that expected at the new interchange. This interchange was within a maintenance plan modeling grid that was predicted to experience PM-10 concentrations of approximately 110 micrograms per cubic meter (the PM-10 standard is 150 micrograms per cubic meter). Since this existing interchange was not predicted to experience violations of the PM-10 standard, and the new interchange would see lower traffic volumes and less development, the team concluded that the new interchange would not be likely to experience violations of the PM-10 standard.

Example D: Comparison of Project Impacts to SIP Modeling

A qualitative analysis was conducted for a major freeway interchange reconfiguration in a suburban location. The region's travel model showed that the reconfigured interchange would experience approximately a 20 percent traffic volume increase over the existing configuration, both because of travel time savings and because the modified interchange would provide access to a new regional mall.

The interagency consultation team decided to evaluate the new interchange by calculating emission levels within the interchange's modeling grid, and comparing them to one of the existing SIP's modeling grids. According to the PM-10 SIP, the grid with the highest emissions levels in the metropolitan area had a modeled concentration of 149.9 micrograms per cubic meter, just below the 150 micrograms per cubic meter PM-10 standard, and had PM-10 emissions in the attainment year of 1.5 tons per day. The team reasoned that, if the grid with the reconfigured interchange were to have emissions of less than 1.5 tons per day, it could also be expected to remain in compliance with the PM-10 standard.

The team located the attainment year emissions estimate for the interchange's grid in the PM-10 SIP document, and then added the emissions expected to result from the increased traffic volumes at the interchange as well as the new regional mall. The resulting total was 1.1 tons per day, well below the 1.5 tons per day in the high grid of the PM-10 SIP's attainment demonstration. Thus, the team concluded that the reconfigured interchange would not experience violations of the PM10 standard.

Example E: Determination of Screening Threshold for Multiple Projects

The State DOT anticipated a large number of new interchange and other projects that would require a PM-10 qualitative analysis in the next few years. The primary source of the area's emissions is from fugitive dust. Rather than convening the interagency consultation team for each individual project, the team agreed that it would be the most efficient use of their resources to develop a screening threshold to which individual projects could be compared. Projects below a certain threshold could proceed without further analysis, while projects that exceeded the threshold would trigger the full review process.

The State DOT retained a consultant to conduct an air quality analysis of some candidate projects. After discussing the situation with the team, it was decided that the best approach would be to determine the largest project that could be constructed without triggering a violation of the PM-10 standard. The consultant conducted an air quality modeling exercise, using typical project configurations and the highest background values typically experienced in the metropolitan area, and concluded that a project would have to generate 500,000 daily VMT within a one-square-mile area in order to cause a potential violation of the PM-10 standard. The vast majority of the projects contemplated by the State DOT fell well below this threshold, and were able to proceed without further analysis (the project documents simply referenced the study and provided project-specific traffic volumes for comparison). The few projects that were over the threshold received a project-level review by the interagency consultation team, and they were designed to include mitigation measures to reduce road dust emissions so that they fell below the emissions levels modeled in the screening study. (The mitigation measures varied by project, but they included steps to reduce soil erosion from landscaped areas, street sweeping on the approach arterials, and use of liquid deicers, which also served to protect the project bridges from corrosion.)

Example F: Comparison of the Project to Another Site Based on Monitoring Data

The project entails a modification to an interchange connecting a primary route to an interstate. The area is a nonattainment area for PM-10. It is a suburban portion of a larger metropolitan city.

A meeting was held to assess the PM-10 impacts considered likely to result from the project and included members from the MPO, FHWA, EPA, State DOT and State Air Quality Agency. This group assessed the project in several areas and concluded that PM-10 was not going to be a problem. In making this determination, several factors were considered including the existing conditions, traffic volume changes, meteorology, location and monitoring stations, and monitored concentration levels. They found the following:

Currently, PM is not a problem at this project site. Members of the interagency council reviewed information supplied by State Air Quality Agency and found the project area did not have any problems with PM-10. Information supplied to this group by the State Air Agency also noted that PM-10 emissions were shown to be decreasing at the project site.

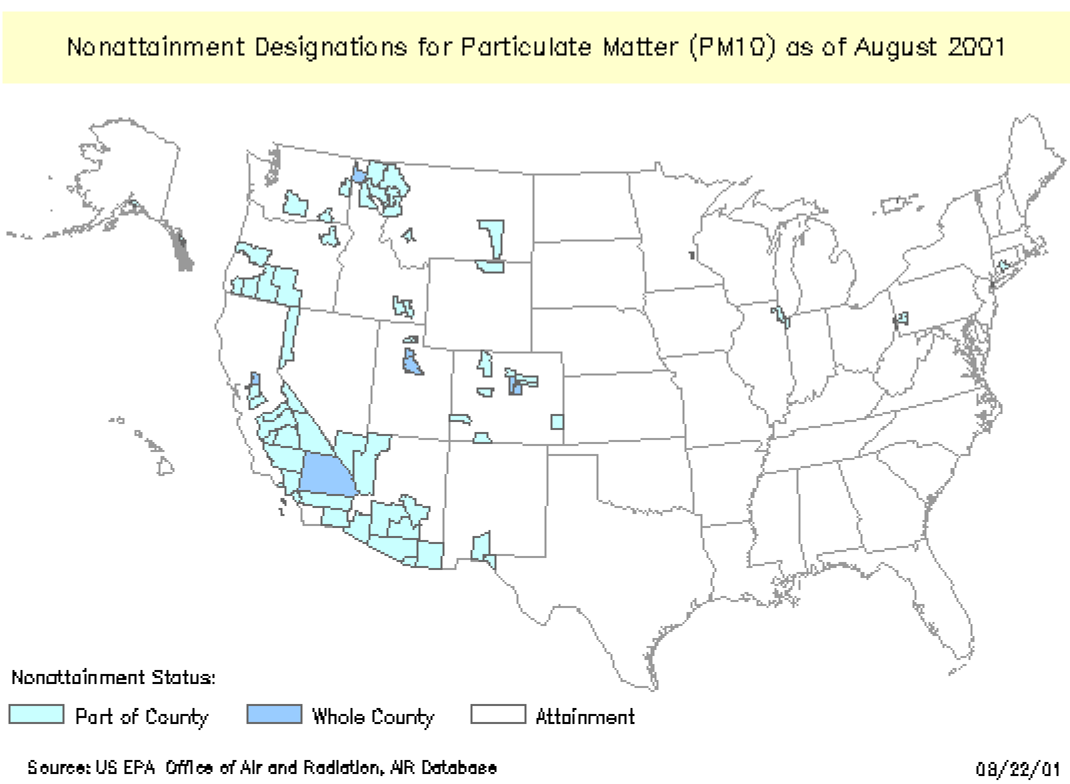
The traffic change resulting from the project has been estimated. This estimate was provided by the State DOT and was found to be consistent with VMT increases in the metropolitan area generally where no increase in PM emissions or concentrations have been noted.

The meteorology at Project X can generally be categorized as variable, the wind varies during the day. There is often some wind which acts to disperse PM emissions at the site. There does not seem to be any noticeable dust contained in the wind. Temperature, humidity, and rainfall do not seem to influence the level of PM pollution at this site.

A monitoring station close by has not registered any violations, and through the consultation process, it was determined that VMT increases from the project would not result in a new violation.

Thus, it would appear that the concentrations of PM at this site on a daily basis are currently within the standards and that future emissions that may result from this project will be low enough that they will not introduce a PM problem.

Figure 1



1. Introduction

This manual is intended to provide guidance in using the CAL3QHC model to predict carbon monoxide levels on roadway intersections in Utah. It provides information on all the variables needed to run the CAL3QHC model including their definitions, how sensitive the model is to each variable, and what values should be used for various conditions. While the intent of this manual is to provide the user with general information regarding the construction of a CAL3QHC air quality model in Utah, users should refer to the Environmental Protection Agency's (EPA) *Guidelines for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005) and the *User's Guide to CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections* (EPA-454/R-006) for more detailed information.

CAL3QHC is an EPA-approved air quality model that is used to predict carbon monoxide (CO) concentrations at roadway intersections. CAL3QHC includes the CALINE3 line source dispersion model that is designed to predict air pollutant concentrations near highways and arterial roads during free-flow operation.

As with any air dispersion model, the quality of the input data will determine the accuracy of the results. When used as a screening tool, conservative assumptions may result in an overly-conservative estimate of the project's environmental impact (i.e. impacts will be overstated). If air quality standards can be met using conservative yet representative assumptions, then no further analysis may be necessary. If standards cannot be met using conservative assumptions, then it will be necessary to use more site-specific information to improve the accuracy of the results. While limited to some degree, both types of analyses can be performed within the parameters of the CAL3QHC model.

If further refinements to the model still do not meet air quality standards, EPA offers the CAL3QHC-R (refined) model. This model allows the use of hour-specific traffic count and weather information and will result in lower, less conservative, environmental impacts. CAL3QHC-R model input requirements are considerably more data intensive than the CAL3QHC version and are not covered in this manual. Model users should refer to the Addendum to the CAL3QHC User's Guide for more specifics of CALQHC-R's capabilities. The use of CAL3QHC-R has not been endorsed by the Federal Highway Administration.

1.1 Hardware and Software Requirements

Any Pentium computer running Windows or DOS 6.0 is sufficient to run CAL3QHC. The CAL3QHC software and User's Guide can be downloaded from the EPA webpage, www.epa.gov/scram001/tt22.htm. The CAL3QHC model is found under the "screening tools" link.

Model input can be written into a text file using a text editor software such as Notepad, Microsoft Word or WordPerfect and is coded as "free flow," meaning data does not need to be placed in fields but must be written in a specific sequence. When saving input from a word processing program, the file must be saved in ASCII or plain text format.

There are Graphic User Interface (GUI) programs that operate with CAL3QHC as a backbone and offer a more "user friendly" environment for data input. These programs provide the ability to input information using a drop-down menu system and prepared table instead of inputting to a text file, as well as giving the user a graphic representation of the intersection constructed in the model and a display of the model's results. Companies that provide CAL3QHC GUI software are:

- Breeze - Roads Suite Software (www.breeze-software.com)
- Lakes – CalRoads View Software (www.weblakes.com)
- Softwair2000 – CalView2 software (www.softwair2000.com)

Also available is a data entry program, *Roadmap*, that does not require a text editor for input. *Roadmap* can be downloaded from the New York State Department of Transportation webpage at www.dot.state.ny.us/eab/airguide.html.

This is not an endorsement for any of the preceding software companies; the information is given only to provide CAL3QHC users additional information and assistance in running the model.

Included in this manual and in the CAL3QHC User's Guide are examples of CAL3QHC model runs with graphics and sample code to assist users in running CAL3QHC.

1.2 Data Input and Requirements

The input variables that are needed to run the model include:

- Road geometry for the intersection, including the physical width of the travel way and length of the roadway, the width of the travel lanes, the location of the stopping lines, sidewalk widths and lengths, and general areas of the intersection where the public will have access. A good graphic of the roadway with a one foot grid overlaying the intersection or a drafting diagram is useful.

- Intersection signal timing (in seconds) including the cycle length and the average red time of each intersection traffic movement. Field calculations should be used to determine existing signal timing. Signal timing may be estimated based on an optimization by a qualified traffic engineer. If signal timing is unknown or if modeling future conditions of an intersection, the National Transportation Research Board's *Highway Capacity Manual* has guidelines and methodologies for determining signal timing optimization. Software programs approved by the National Transportation Board are also available to determine signal optimization.

- Existing and future traffic volumes.

- Existing and future general land use for the area.

- Emission rates and ambient background carbon monoxide levels. This information is included in this manual for all counties in Utah.

- Meteorological conditions, which are included in Section 4 of this manual.

1.3 Data Output

After successfully running the CAL3QHC model, a text file will be generated. On the last page of output generated, there will be text similar to:

"THE HIGHEST CONCENTRATION OF 17.90 PPM OCCURRED AT RECEPTOR REC20."

CAL3QHC determines the highest 1-hour concentration of carbon monoxide. However, the National Ambient Air Quality Standard (NAAQS) for carbon monoxide is given in an 8-hour concentration. In order to convert a 1-hour concentration to an 8-hour concentration, a "persistency factor" is applied to the 1-hour concentration to produce an 8-hour average concentration. The EPA recommends using a default persistency factor of 0.7 (approximately 70 percent) be applied to the 1-hour value. However, this value may fluctuate significantly depending on an area's meteorological conditions and on changes in traffic volume during the 8-hour period. The Utah Division of Air Quality has verified that a persistency factory of 0.7 is reasonably accurate for local conditions of CO episodes.

To convert a 1-hour value to an 8-hour value calculated, the following calculation should be used:

$$CO_8 = (CO_1 - BG_1) \times .70 + BG_8$$

Where:

- CO_8 = 8-hour CO value
- CO_1 = Highest value 1-hour concentration from CAL3QHC output
- BG_1 = 1-hour background concentration (see section B-4.1)
- .70 = The default persistency factor
- BG_8 = The background 8-hour concentration (see section B-4.1)

1.4 Air Quality Standards

The 1-hour and 8-hour National Ambient Air Quality Standard (NAAQS) for carbon monoxide is 35.0 parts per million and 9.0 ppm, respectively. The Clean Air Act states that a transportation project cannot cause an exceedance of the NAAQS, and that a project cannot worsen an already-existing exceedance. However, a project might have positive impacts on an existing exceedance, decreasing the level of carbon monoxide, but still be above the NAAQS. Under these conditions, projects can move forward.

2. Roadway Geometry

A roadway link is a representation of a roadway that travels from point A to B without changing direction, speed, or road width. CAL3QHC is able to model up to 120 roadway links per input file. Prior setting up a CAL3QHC input file it is helpful to have a scaled drawing or the dimensions of the intersection or roadway that is to be modeled. Aerial photos and topographical maps are available online from the US geological Survey, as well as a number of private vendors (http://terraserver.homeadvisor.msn.com/default.aspx is one example). With some basic mapping or drawing software, these images can be downloaded and set to scale to provide all the dimensional information needed to construct a CAL3QHC model.

2.1 Road Type

Definition: Four types of roadways can be modeled in CAL3QHC:

- At grade (AG), is a level roadway.
- Filled (FL), a roadway that has been built up over a level surface such as most rural freeways.
- Depressed (DP), a roadway that is built below surface.
- Bridged (BR), any bridge span including over passes and flyovers.

Sensitivity: When modeling sources 'at grade', the model assumes that the ground acts as a physical barrier and will only allow the pollutant to expand outward and upward. For 'filled' or 'bridged' roadways, the model assumes that additional expansion can occur downward also, thereby allowing for more dispersion during transport. Changing the type of road type will have a small impact on the final result of the model.

Value to Use: The recommended value is "at grade" (**AG**), which is how most roadways will be modeled in Utah.

2.2 Free Flow Links

Definition: Free flow links are those that travel from point A to B without stopping for a signal or a change in speed or direction. Free flow links can be used to model freeways, arterials, and local streets as long as there is no interruption in travel direction or speed. Links that can be modeled as free flow links are right turn lanes, through lanes, and left turn lanes.

Sensitivity: Not Applicable

Value to Use: The input required is the X/Y and beginning and ending coordinates of the link. The coordinates can be arbitrary, meaning any location can be the 0,0 point. The coordinates must be in feet.

For example, when modeling an intersection with a signal, the approach links and departure links are modeled as free flow links. The approach link would be coded from the beginning of the point to the middle of the intersection. The departure link would be coded from the middle of the intersection to the end of the link. (See Example 1) In Utah, a typical block length is 700 feet. Free flow links should be coded as 700 feet long for most urban applications but may be coded as much as 1,000 feet long on congested roadways.

2.3 Queue Links

Definition: Queue links are where traffic will queue while waiting for a signal to change. Links that can be modeled as queue links are right turn lanes, through lanes, and left turn lanes.

Sensitivity: Not Applicable

Value to Use: When writing code for queue links, the first X/Y coordinate entered would be the starting point where the queue would begin (e.g. the stop bar at an intersection). The X/Y coordinate of the ending of the queue link would have one of the same X/Y points as the arrival free flow link on an intersection. For right or left turn lane queues, the end of the queue link would be the end of the turn pocket (see Example 1). Where turn pocket lengths are not available typical input values for left run queue lengths are the number of left turning vehicles per lane per hour equals the queue length in feet but not less than 150 feet. Typical queue lengths for right turn vehicles are 0.5 times the number of right turning vehicles per hour (in feet), but not less than 200 feet. Queue links do not need to be defined to the exact length of the queue but should extend back from the intersection far enough to capture the entire queuing traffic volume during each signal cycle. CAL3QHC will calculate the length of the queue dependant on traffic volume and signal timing.

2.4 Receptor Locations

Definition: CAL3QHC's purpose is to determine where CO and PM10 levels will be at their highest depending on existing or future traffic volumes, queue lengths, traffic signal timing, and meteorological conditions.

Sensitivity: Receptor location is very important in creating a precise model of future and existing conditions. Incorrect receptor placement can present erroneous results and careful consideration should be made in the placement of the receptor locations in the model. The main point of the analysis is to identify the point and extent of the maximum impact. Once the user has been able to identify the area of highest impact, additional receptors should be placed in that area to identify the location and extent of the maximum impact.

Value to Use: In general, receptor placement should be at least 10 feet from the edge of the outside-most travel lane and run parallel to the roadway.

On roadways such as freeways where access is limited, receptor placement should be at least 10 feet from the outside-most travel lane or where the public has access, such as a right-of-way fence line.

Receptor height should be set to six feet, which is considered normal breathing height. Where applicable, receptor height on elevated roadways should be placed at 6 feet above the roadway.

When modeling receptor locations, each receptor should be placed outside the mixing zone width (see Section 2.6) where queues begin to develop, such as the stop bar of an intersection or at a crosswalk. For planning and design purposes, a typical stop bar is painted at the intersection on the edge of the radius of the curb. A typical radius for an intersection curb is 25 feet. In all cases, receptors should be located on the adjacent sidewalk; if no sidewalk exists it is recommended that the receptors be placed 10 feet (3 meters) away from the most outside lane of the traveled roadway.

Receptors should be located near the corner and at mid-block for each approach and departure of the intersection. Receptors should be placed on both sides of the roadway. For long approaches and where heavier traffic volumes are expected, it is recommended that five receptors be located at 75 foot intervals from the intersection corner. For heavily traveled roadways receptors may be spaced further apart on one model ran and a second model run may be performed with additional receptors. Up to 60 receptors can be used.

Examples of Reasonable Receptor Sites:

- All sidewalks to which the public has access
- A vacant lot near an intersection where the public would have continuous access in the immediate vicinity of the roadway
- In the vicinity of parking lot entrances and exits, provided a nearby area contains a public sidewalk, residences, or structures to which the public is likely to have continuous access

Note: Sidewalks present a problem in that the public is unlikely to occupy a relatively small portion of the walkway continuously. Nevertheless, the public does have access to the whole sidewalk on a continuous basis. Thus, it is appropriate to consider the whole sidewalk as a reasonable receptor site. For the analysis procedures in this guidance, a receptor should be located at least 10 feet from each of the most outside travel lane that comprises the intersection. If the width of the sidewalk allows, it is recommended that receptors be placed at the midpoint between the curb and the building line.

Examples of Unreasonable Receptor Sites:

- Median strips of roadways
- Locations within the right-of-way on limited access highways
- In intersections or on crosswalks at intersections
- In tunnel approaches
- In tollbooths

(EPA) *Guidelines for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005)

2.5 Surface Roughness

Definition: Changes in the surface of the land affect the way the air moves across. Different land uses provide for different levels of “surface roughness”. Objects extending up from the surface create eddies in the air which allow for additional amounts of clean air to be mixed with polluted air, thereby enhancing dispersion. In general, the more pronounced the roughness of the earth's surface, the larger and more frequent the eddies close to the surface will be. Forests and large cities create larger and more frequent eddies than flatter open areas such as airport runways, fields, or areas covered by long grasses, shrubs and bushes.

Sensitivity: Surface roughness will have a significant influence the model’s predicted concentration; the lower the surface roughness value, the higher the predicted CO concentration levels will be.

Value to Use: Although many other surface roughness measurements are available in the CAL3QHC User’s Guide, the recommended inputs for typical land uses are:

Rural: Cultivated areas with low crops and occasional obstacles such as trees or hedgerows, vineyards. ***Value = 10 cm***

Suburban: Regular coverage with large obstacles, some open spaces such as parking lots, parks and recreation areas, golf courses. Suburban houses, strip malls, commercial and residential structures two stories or less, villages. ***Value = 108 cm***

Central Business District: Centers of large towns or cities containing densely located structures three stories or higher, mature forested area.
Value = 175 cm

It is not necessary to convert these values from metric to English.

2.6 Link Width

Definition: The link width or "mixing zone" is the area where the carbon monoxide is first emitted from automobiles before it is dispersed by the wind.

Sensitivity: The wider the roadway, the more the CO will be dispersed along the roadway link, generally lower concentrations will be produced on wider roadways.

Value to Use: On **free flow links**, air flowing around cars moving along the traveled roadway creates a turbulent region extending out beyond the traveled roadway, into which emissions are mixed. The link width equals the width of the road plus 10 feet (3 meters) on either side. For example, on a road that is two lanes in each direction with 12-foot travel lanes, the link width would be 44 feet for each direction. Adding 10 feet to either side of the free flow roadway link is to account for the wake that is created by moving vehicles.

On **queue links**, it is not necessary to add 10 feet to the travel lane width. Idling cars fill the traveled roadway region with tailpipe emissions. For example, the queue link representing a two-lane in each direction road with 12-foot travel lanes that queue in each direction at an intersection would be 24 feet.

3. Traffic

All traffic links used in the CAL3QHC model require that link specific traffic data such as signal timing, X and Y coordinates, saturation flow rates and other data be included. The model is very sensitive to these inputs and the more accurate the data, the more accurate the predicted concentrations will be. Three traffic parameters, saturation flow rate, signal type, and arrival rate, will affect the intersection's volume to capacity ratio, delay, and queue length.

Signal timing affects the model in two ways. First, the longer a vehicle is queued during a signal cycle, the more emissions are emitted by the source. Second, the length of the queue is determined by the volume of traffic divided by the capacity of the link. Since the capacity of the link is affected by the red time of the signal cycle, the longer the red time, the smaller the available capacity and the longer the queue length. Guidelines and methodology for determining signal timing based on traffic volume and geometry is contained in the Transportation Research Board Publication *Highway Capacity Manual 2000* Section 16. Computer software is also available to help in determining optimal signal length.

3.1 Signal Type

Definition: CAL3QHC has three values that can be entered for signal type:

- Pre-timed, which runs on a pre-timed cycle.
- Actuated, which is actuated whenever a vehicle is detected at an intersection.
- Semi-actuated, which is pre-timed during peak hours, and actuated during off peak hours.

Sensitivity: CAL3QHC does not appear to be very sensitive to this input.

Value to Use: Based on the type of signal that is at the intersection, enter:

- 1 for pre-timed or coordinated signals.
- 2 for actuated
- 3 for semi-actuated
- If the signal type is unknown, enter 1.

3.2 Cycle Length

Definition: Pre-timed signals usually have different cycle lengths (beginning of green to beginning of green time for the same movement) during different times of the day. Because CAL3QHC primarily models for peak hours, the pre-timed value during the peak hour should be used.

Sensitivity: CAL3QHC is very sensitive to this input. Longer cycles with higher volumes of traffic will produce higher concentrations of carbon monoxide. Shorter cycles with smaller traffic volumes will produce lower concentrations of CO. This value also determines the time between cycles and how long each vehicle will remain in the queue and is also part of the calculation of the volume to capacity ratio.

Value to Use: The cycle length (in seconds) is entered. If a semi-actuated signal is being modeled, use the approximate timing during peak hours. The cycle length value is determined by field observation for existing conditions analysis. Cycle lengths will generally vary between 30 and 150 seconds, with longer cycles required for busier, more complex intersections. For future conditions, use the guidelines and methodology presented in the *Highway Capacity Manual* or other signal timing software.

3.3 Average Red Time

Definition: Average red time is the number of seconds of red time that one specific traffic movement (left turns, for example) will be red in one signal cycle. This is *not* average red time for each leg of the intersection, but rather each movement of a leg of an intersection.

Sensitivity: CAL3QHC is very sensitive to this input. This determines the amount of time that a vehicle will sit in the queue emitting CO.

Value to Use: The average red time value for each movement can be determined by field observation for existing conditions analysis. Average red time is the total signal cycle time minus green and yellow time for that movement. For future conditions, use the guidelines and methodology presented in the *Highway Capacity Manual* or other signal timing software.

3.4 Clearance Interval Lost Time

Definition: Clearance interval lost time is "the portion of the yellow and all red time that is unused during each signal phase at which point during an intersection is not used by any traffic" (Transportation Research Board, *Highway Capacity Manual 2000,* Section 10-12). This includes the startup time and stop time between green and red cycles.

Sensitivity: CAL3QHC is sensitive to this input. Clearance interval lost time will affect the volume to capacity of the approach lane.

Value to Use: A clearance interval lost time of **two seconds** is recommended as a default value to reflect "normal or average" driver behavior. Longer lost times up to 3 or 4 seconds may be assumed for larger, high speed, intersections.

3.5 Traffic Volume

Definition: Traffic volume refers to the number of vehicles arriving at the intersection in one hour. The value in CAL3QHC is the total number of vehicles on the travel link per hour. If there are multiple lanes contained within a single link, the traffic volume is the total number of cars passing through that link in one hour, not the number of vehicles per hour per lane.

Sensitivity: An increase in the traffic volume on a queue link will result in longer queue lengths. Higher traffic volumes on a queue link will create greater concentrations of CO at receptors near the mid-block more than at the intersection.

Value to Use: If modeling an existing intersection, use the value generated by field measurements. A travel model can determine the number of vehicles that will be on the road for future years.

3.6 Saturation Flow Rate

Definition: Saturation flow rate is the hourly rate at which vehicles can proceed through an intersection assuming that the green light is available at all times and no lost times are experienced. This value is in vehicles per hour per lane.

Sensitivity: CAL3QHC is sensitive to saturation flow rate and careful consideration needs to be made based on field calculations and the recommendations below.

Value to Use: Although the default saturation flow rate given in the CAL3QHC users guide is 1,600 vehicles per hour per lane, this value is generally lower based on the *Highway Capacity Manual*.

Use the default values in the following table for all projects. Typical values for urban areas are between 1,700-1,950 vehicles per hour. Central Business Districts have a range of between 1,600-1,800 vehicles/lane/hr.

Area Type	Default Value	Range (veh/lane/hr.)
CBD	1,700	1,600-1,800
Other	1,800	1,700-1950

Source: *Transportation Research Board Highway Capacity Manual 2000* Section 10-24

The saturation flow rate may be increased or decreased based on approach speeds or a calculated value. Intersections with faster approach speeds will have higher saturation flow rates. For example, approaches with speeds of 30mph will have a saturation flow rate of about 1,800 vehicles/lane/hour. Approaches with faster speeds (greater than 50 mph) will have saturation flow rates of approximately 1,900 veh/lane/hour.

3.7 Progression or Arrival Rate

Definition: Progression or arrival rate is the rate at which vehicles can move through the intersection. Five values are available to use in CAL3QHC. Many factors can influence progression such as the distances between upstream and downstream signals, signal timing between the upstream and downstream signals, and the number of vehicles traveling on the roadway.

Sensitivity: CAL3QHC is not very sensitive to progression but it is recommended that the values below are used, based on field observation.

Value to Use: This value is determined by field observation of signal spacing and timing. There are five possible values to use.

1 = Worst progression, dense platoon at beginning of red cycle and traffic signals closer than .25 miles apart.

2 = Below average progression, dense platoon during middle of red cycle and traffic signals are closer than .25 miles apart.

3 = Average progression, traffic arrives at the intersection randomly and traffic signal spacing is between .25 and .5 miles apart.

4 = Above average progression, dense platoon during middle of cycle and traffic signals are evenly spaced between .25 and .5 miles apart.

5 = Best progression, dense platoon arrives at the beginning of cycle, signals spacing is at approximately .5 miles apart.

If the value is unknown for future conditions, use the “3” (average progression). Generally, coordinated traffic signals will have better progression and higher arrival rates.

3.8 Emission Rates

Definition: As vehicles move, carbon monoxide is emitted from the tailpipe. Faster moving vehicles have lower emission rates than slower moving vehicles. Emission rates used in the model are expressed in grams per vehicle mile for free flow links or in grams per vehicle hour for queue links. CAL3QHC combines the vehicle emission rate with the traffic volume to determine the total emissions from all vehicles operating inside the free flow or queue links. Emission rates will change from year to year as cleaner fuels and better electronic controls for vehicles are developed and as laws for better emission controls are enacted. In Utah, many counties have different emission rates due to different inspection and emission (I/M) programs, climate and topography.

Sensitivity: CAL3QHC is very sensitive to all emission rates and it is very important to use the correct value.

Value to Use: Two types of emission rates used in the model:

- **Free flow emission rates** are used for free flow links. The value is in grams per vehicle mile. This unit is used when running CAL3QHC in English or Metric units.
- **Idle emission rates** are used for idling vehicles on queue links. The value is in grams per hour. This unit is used when running CAL3QHC in English or Metric units.

The emission rates were developed in conjunction with Federal Highway Administration, Wasatch Front Regional Council and Mountainland Association of Governments using MOBILE6.2. The rates provided exclude any cold start emissions because modern vehicles warm up quickly and MOBILE6's default distribution of start emissions would cause an overestimation of intersection emission rates in many cases.

A table of emission rates for all counties in Utah is provided in the Appendix, Tables 1-12. The emission rates were developed using MOBILE 6.2, an EPA-approved model for estimating emission rates from vehicles. The emission rates are based on an average winter temperature for each county; the lower the temperature the higher emission rates. The tables are estimations of future emission rates in Utah. Emission rates for counties that do not have inspection and maintenance (I/M) programs have been grouped by average winter temperature. A map of these groups of counties is in Appendix A, Figure 1. Find the county where the project is located and refer to the appropriate emission rate tables for queue links or free flow links.

4. Meteorological Conditions

There are a number of meteorological conditions that can be simulated in the CAL3QHC modeling process. Because it is important in hot spot analysis to identify and model the worst case scenario, care should be taken in choosing meteorological conditions which might occur in the project area that would contribute to the highest concentration of emissions. These conditions generally occur when the wind speed is very low and the atmosphere has very few eddies to enhance mixing of the pollutant with clean air around the roadway. Meteorological variables used in CAL3QHC include wind speed, wind direction, mixing height, and stability class.

For all projects, it is only necessary to model one set of meteorological conditions. However, for this reason it is especially important that meteorological conditions represent a worst-case scenario of weather conditions that have historically occurred in the project area.

4.1 Ambient Background Carbon Monoxide

Definition: Ambient background carbon monoxide concentration (background concentration) is the level of CO in the air that would be there regardless of how well the intersection functions. Background concentration values are measurements from air monitoring sites or other data collected in the area. Since the carbon monoxide NAAQS allows for one exemption of the highest recorded value from each year, the background concentration should be representative of the second-highest value for the year, and should be assessed over a period of the 5 to 10 years.

Sensitivity: CAL3QHC is very sensitive to this input. CO concentration are additive of the background value. If the results are above the NAAQS, the ambient background CO concentration is one variable that should be scrutinized.

Value to Use: Following is a table of 1-hour and 8-hour CO background concentrations for counties and major cities in Utah that has been prepared through consultation with the Utah Division of Air Quality. Future background values are generally expected to decline. However, as a conservative assumption, future background values have been held constant to existing values. When more precise background values are required, the background concentration may be adjusted by the ratio of future to existing vehicle miles of travel (VMT) in the county times the ratio of future existing emission rates.

1-hour and 8-hour Background Values of Carbon Monoxide

Cites/Counties with I/M Programs	**1-HOUR (ppm)**	**8-HOUR (ppm)**
Salt Lake City	12	6
Salt Lake County (other than Salt Lake City)	12	6
Ogden	12	6
Weber County (other than Ogden)	12	3
Provo/Orem	14	6*
Utah County (other than Provo or Orem)	14	5
Davis County	8	5
Cites/Counties without I/M Programs		
Logan	8	5
St. George	8	4
Cache County (other than Logan)	3	1
Iron County	3	1
Washington County (other than St. George)	3	1
Northern Counties (Box Elder, Rich, Morgan, Summit, Wasatch, Daggett)	3	1
Southeast Counties (Wayne, Garfield, Kane, Emery, Grand, San Juan)	3	1
Northeast Counties (Uinta, Carbon, Daggett, Duchesne)	3	1
Western Counties (Tooele, Juab, Millard, Beaver)	3	1
Central Counties (Piute, Sevier, Sanpete)	3	1

*The Utah Division of Air Quality is currently in the process of developing an Urban Airshed Model (UAM) that will better define background concentrations in Utah County.

4.2 Stability Class

Definition: The atmospheric stability class refers to the amount of eddie turbulence that exists in the atmosphere. Micro-scale eddies, those which are most likely to effect localized dispersion, are either mechanically created or thermally created. Mechanically created eddies development will depend on the speed of the wind and any size and density of physical obstructions around the roadway. The influence of mechanical eddies is accounted for in the surface roughness parameter discussed earlier in this document. Thermal eddies are created by the sun's warming of the earth's surface. Thermal eddies usually start to develop after sunrise and continue into the evening as the ground gives off heat stored during the day. When large amounts of thermal eddies are present, the air is said to be unstable. During the late evening and through the night into early morning hours when there is no more heat energy to be given off, eddy development is at a minimum, and the air is said to be stable.

Sensitivity: CAL3QHC is very sensitive to this input. Higher values result in higher concentrations of CO.

Value to Use: The CAL3QHC User's Guide provides a default value of 4. However, for all areas in Utah, **a value of 5** (stable) should be used.

4.3 Utah Meteorological Constants

4.3.1 Settling Velocity

Definition: Settling velocity is the rate at which a particulate falls to the ground. Settling velocity is used in modeling solid particles such as PM_{10}, and is not used in carbon monoxide analysis since the pollutant is in a gas state, and is assumed to remain suspended.

Sensitivity: Not Applicable to carbon monoxide analysis.

Value to Use: The **value will always be 0** meters/second for gaseous pollutants.

4.3.2 Deposition Velocity

Definition: Deposition velocity is the rate at which a particulate matter adheres to another surfaces. Deposition velocity is used in modeling solid particles such as PM_{10}, and is not used in CO analysis since the pollutant is in non-reactive gas state, and is assumed to remain suspended.

Sensitivity: Not Applicable to carbon monoxide analysis.

Value to Use: The **value will always be 0** meters/second for non-reactive gaseous pollutants.

4.3.3 Source Height

Definition: This is the average distance from ground level to tailpipe emission sources.

Sensitivity: CAL3QHC is sensitive to this input.

Value to Use: The EPA default value is **1 foot.** This value is generally used. However If modeling an overpass or bridged roadway where traffic links are above grade, it is possible to change this value to ±32 feet where applicable.

4.3.4 Wind Speed

Definition: This is the speed of the wind at the roadway. Wind speed will determine the rate at which CO will be moving through the air. Low wind speeds minimize the introduction of surrounding clean air to disperse the pollutants, while the higher the wind speed, the more dispersion that will occur.

Sensitivity: CAL3QHC is sensitive to this value. Pollutant concentrations near the roadways tend to be inversely proportional to the wind speed (larger volumes of air moving over the roadway enhances dispersion, producing lower concentrations).

Value to Use: To properly estimate a worst-case scenario, the wind speed will **always be measured at 1 meter/second**. Although most other data entered in CAL3QHC is in feet, this input will always be in meters.

4.3.5 Wind Direction

Definition: This is the wind direction that CAL3QHC will use. To properly simulate the direction of air movement across roadways under worst-case conditions, we must assume that the wind could come from any direction. Therefore it will be necessary to instruct the model to look at wind directions ranging from 0 to 360 degree. This is generally done in 10-degree increments. However, once the area of the intersection having the highest model predicted has been identified, the model may be rerun with wind direction increments of 5 degrees for this area to identify the area and extent of the maximum impact.

Sensitivity: Not Applicable

***Value to Use*:** It is possible to narrow the wind direction increments in CAL3QHC to one degree and measure CO concentration from that direction only. Hot spot analysis is intended to determine the highest concentration of CO at any location around the project intersection. For the first run, to identify the area of maximum impact, the wind direction increment should be set to 10 degrees, with the wind direction range beginning at 0 and going to 36.

4.3.6 Mixing Height

Definition: Mixing height is the height (in meters) of the topmost layer in the atmosphere where most air mixing takes place. This top most layer will serve to trap the emissions below it, thereby limiting dispersion along the vertical axis. For impacts close to the intersection, the mixing height is not critical, since it is unlikely that the pollutant will expand that much in the vertical before affecting the area where receptors are located.

Sensitivity: Not Applicable

Value to Use: The EPA **default mixing height is 1,000 meters**. This value will be used for all project analysis. Although most other data entered into CAL3QHC is entered in feet, this input will always be in meters.

5. Examples

The following section contains eight examples of analyses of models using CAL3QHC. The examples should provide enough information to successfully model and predict CO emissions using CAL3QHC on most intersections in Utah. The examples include a simple 4-way intersection, high volume arterial, two complex 4-way intersections, T-intersection, a multiple 4-way intersection, a stop-controlled intersection, freeway mainline and a freeway interchange.

Each of the examples are based on typical roadway cross sections. Each model example includes hypothetical traffic volumes and road networks. Each model example uses the 2003 emission rates included in the Appendix and background concentrations found in Section 4.1 in this manual. Each example includes a diagram of the modeled intersection and the CAL3QHC data input needed to run each model.

Each input variable must be written in sequence. The number of spaces between each input variables does not matter.

There are three types of data that can be entered:

- **CHARACTER** is text input and must be enclosed with single quotes.
  Example 'RIVERBEND ROAD WEST'

- **REAL NUMBER** must have a decimal point following the whole number.
  Example 12.3

- **INTEGER** is a whole number and must not have decimal in the number.
  Example 123

In the Appendix, Table 10 describes the sequence and type of data used to code a roadway. Appendix Table 10 could be considered a "cheat sheet" for CAL3QHC input.

CAL3QHC Execution:

CAL3QHC is executed by the command

CAL3QHC (name of input file).dat path and file destination

Example from a DOS prompt.

CAL3QHC intersection.dat c:\temp\intersection.out

It is possible to create a batch (.bat) file and execute many CAL3QHC jobs at one time.

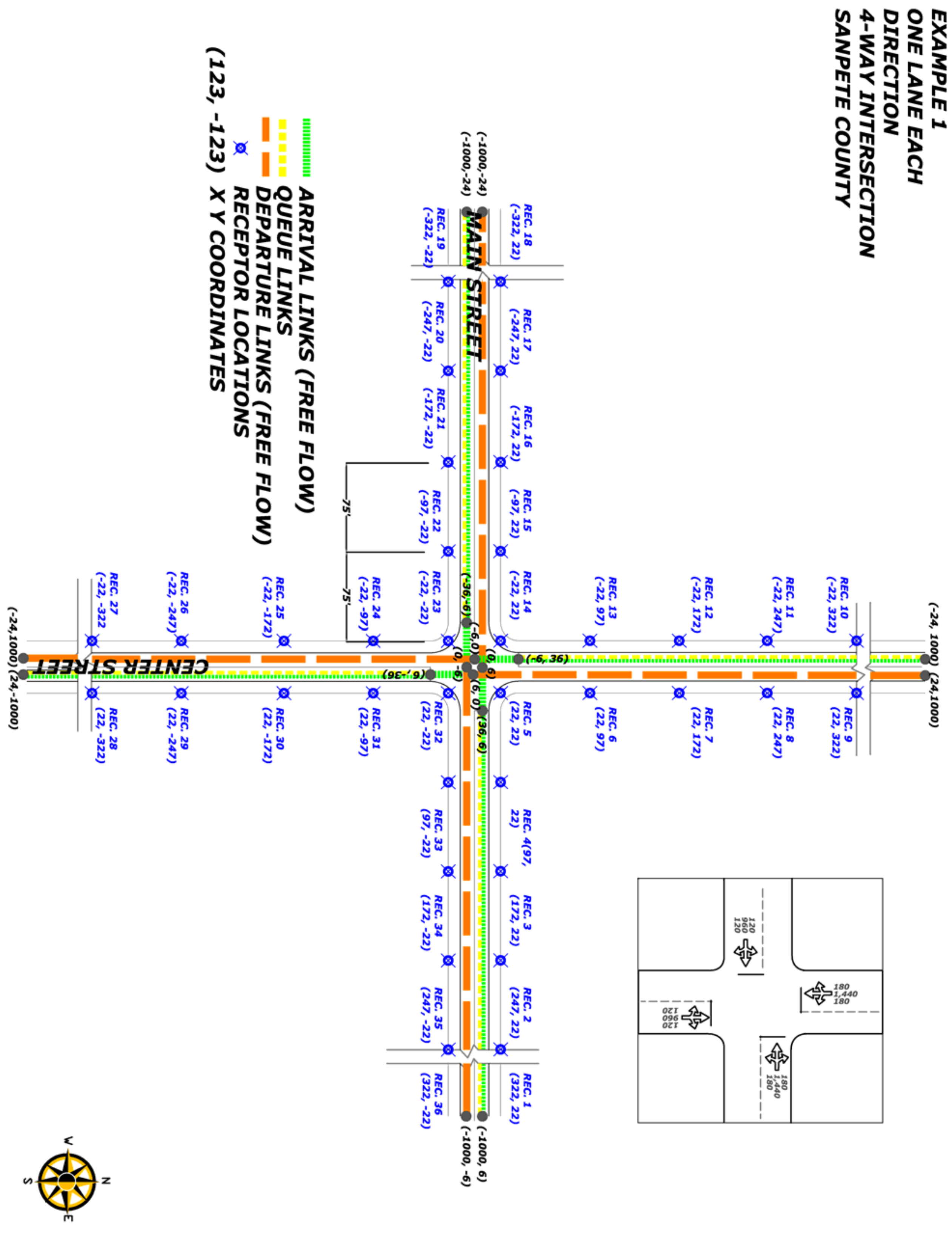
5.1 Example 1: One Lane Each Direction

Example 1 is a 4-way high traffic intersection located in Sanpete County. Signals have been optimized using, *Synchro* traffic software. There is one travel lane in each direction. All travel lanes are 12'.

Included in this example is a diagram of the intersection. The diagram shows the link beginning and ending points, receptor locations and turn movements for each link.

This example also shows the sequence of the CAL3QHC data layout as well as the input and output of the model.

Example 1: Diagram of Intersection



Example 1: Input Code

This is how the code should appear for Example 1 in 'Notepad' or any other text editor.

```
'4-WAY' 60.  10.  0.  0.  36  0.3048 1 1
'REC 1'     322.    22.     6.
'REC 2'     247.    22.     6.
'REC 3'     172.    22.     6.
'REC 4'      97.    22.     6.
'REC 5'      22.    22.     6.
'REC 6'      22.    97.     6.
'REC 7'      22.   172.     6.
'REC 8'      22.   247.     6.
'REC 9'      22.   322.     6.
'REC 10'    -22.   322.     6.
'REC 11'    -22.   247.     6.
'REC 12'    -22.   172.     6.
'REC 13'    -22.    97.     6.
'REC 14'    -22.    22.     6.
'REC 15'    -97.    22.     6.
'REC 16'   -172.    22.     6.
'REC 17'   -247.    22.     6.
'REC 18'   -322.    22.     6.
'REC 19'   -322.   -22.     6.
'REC 20'   -247.   -22.     6.
'REC 21'   -172.   -22.     6.
'REC 22'    -97.   -22.     6.
'REC 23'    -22.   -22.     6.
'REC 24'    -22.   -97.     6.
'REC 25'    -22.  -172.     6.
'REC 26'    -22.  -247.     6.
'REC 27'    -22.  -322.     6.
'REC 28'     22.  -322.     6.
'REC 29'     22.  -247.     6.
'REC 30'     22.  -172.     6.
'REC 31'     22.   -97.     6.
'REC 32'     22.   -22.     6.
'REC 33'     97.   -22.     6.
```

Example 1 – Input Code (Cont.)

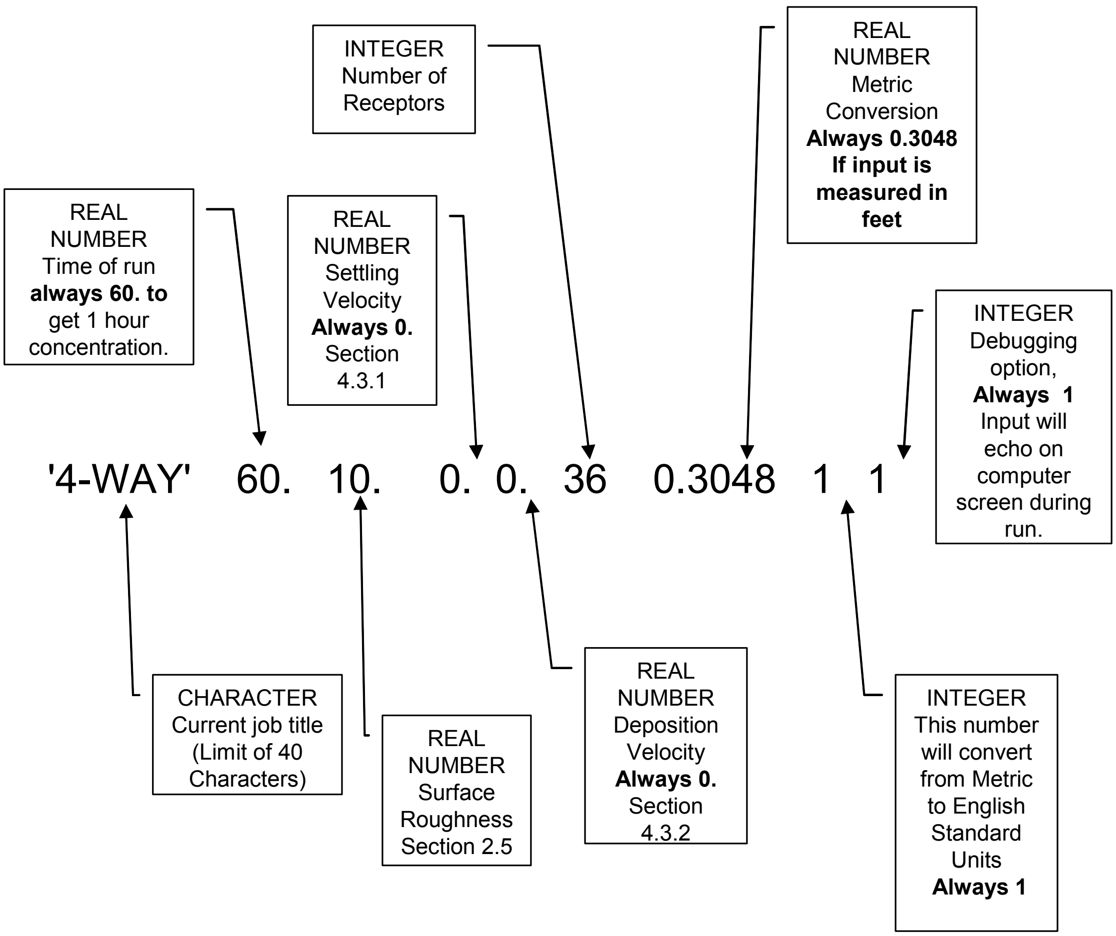
```
'REC 34'    172.   -22.     6.
'REC 35'    247.   -22.     6.
'REC 36'    322.   -22.     6.
'1-LN EACH DIRECTION'     12  1  0  'C'
1
'MAIN ST WB APPR.'    'AG'      0.      6.     1000.       6.     380.  15.8  1.  32.
2
'MAIN ST WB QUEUE'    'AG'     36.      6.     1000.       6.        1.  12.   1
      40   20 2. 380  193.1  1800 1 3
1
'MAIN ST WB DEP.'     'AG'      0.      6.    -1000.       6.     370.  15.8  1.  32.
1
'MAIN ST EB APPR.'    'AG'      0.     -6.    -1000.      -6.     300.  15.8  1.  32.
2
'MAIN ST EB QUEUE'    'AG'    -36.     -6.    -1000.      -6.        1.  12.   1
     40   20 2. 300  193.1  1800 1 3
1
'MAIN ST EB DEP.'     'AG'      0.     -6.       -6.   -1000.     310.  15.8  1.  32.
1
'CENTER ST NB APPR.'  'AG'      6.      0.        6.   -1000.     300.  15.8  1.  32.
2
'CENTER ST NB QUEUE'  'AG'      6.    -36.        6.   -1000.       1.  12.   1
     40   20 2. 300  193.1  1200 1 3
1
'CENTER ST NB DEP.'   'AG'      6.      0.        6.    1000.     310.  15.8  1.  32.
1
'CENTER ST SB APPR.'  'AG'     -6.      0.       -6.    1000.     380.  15.8  1.  12.
2
'CENTER ST SB QUEUE'  'AG'     -6.     36.       -6.    1000.       1.  12.   1
     40   20 2. 380  193.1  1800 1 3
1
'CENTER ST SB DEP.'   'AG'     -6.      0.       -6.   -1000.     370.  15.8  1.  12.
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

Example 1: Input Description

Example 1

LINE 1 of EXAMPLE 1

PROJECT SETUP



Example 1

LINE 2 of Example

RECEPTOR INPUTS

REAL
NUMBER
X-Coordinate
of Receptors

CHARACTER
Receptor name
Up to 20
Characters

REAL NUMBER
Y-Coordinate of
Receptor

REAL NUMBER
Z-Coordinate of
Receptor height will always be 6.
which is average
breathing height
Section 2.4

'REC 1'	322.	22.	6.
'REC 2'	247.	22.	6.
'REC 3'	172.	22.	6.
'REC 4'	97.	22.	6.
'REC 5'	22.	22.	6.
'REC 6'	22.	97.	6.
'REC 7'	22.	172.	6.
'REC 8'	22.	247.	6.
'REC 9'	22.	322.	6.
'REC 10'	-22.	322.	6.
'REC 11'	-22.	247.	6.
'REC 12'	-22.	172.	6.
'REC 13'	-22.	97.	6.
'REC 14'	-22.	22.	6.
'REC 15'	-97.	22.	6.
'REC 16'	-172.	22.	6.
'REC 17'	-247.	22.	6.
'REC 18'	-322.	22.	6.
'REC 19'	-322.	-22.	6.
'REC 20'	-247.	-22.	6.
'REC 21'	-172.	-22.	6.
'REC 22'	-97.	-22.	6.
'REC 23'	-22.	-22.	6.
'REC 24'	-22.	-97.	6.
'REC 25'	-22.	-172.	6.
'REC 26'	-22.	-247.	6.
'REC 27'	-22.	-322.	6.
'REC 28'	22.	-322.	6.
'REC 29'	22.	-247.	6.
'REC 30'	22.	-172.	6.
'REC 31'	22.	-97.	6.
'REC 32'	22.	-22.	6.
'REC 33'	97.	-22.	6.
'REC 34'	172.	-22.	6.
'REC 35'	247.	-22.	6.
'REC 36'	322.	-22.	6.

Example 1

LINE 3 of Example 1

PROJECT SETUP

CHARACTER
Run Title 40
Characters Max.

INTEGER
Number of
Meteorological
Conditions
Always 1

CHARACTER
Always ‘C’
for CO
analysis

'1-LN EACH DIRECTION' 12 1 0 'C'

INTEGER
Number of
Links
Section 2.2-
2.3

INTEGER
Enter 1 for
long output
table or **0**
for short
output

Example 1

LINES 4 and 5A of Example

FREE FLOW LINK INPUT

*All approach and departure links are modeled as free flow links.

*If modeling a free flow link only line 5A is required

REAL NUMBER
X Coordinate of
Beginning of Link
Section 2.2

REAL NUMBER
Y Coordinate of
Beginning of Link
Section 2.2

INTEGER
TYPE OF LINK
"1" for Free Flow "2" for Queue
Section 2.2-2.3

CHARACTER
Road Type
Section 2.1

REAL NUMBER
Traffic Volume
on Link
Section 3.5

1

'MAIN ST WB APPR.'   'AG'   0. 6.   1000.   6.   380. 15.8 1. 32.

CHARACTER
Link Name 20
Character Max

REAL NUMBER
X Coordinate of
Ending of Link Section
2.2

REAL NUMBER
Y Coordinate of
Ending of Link Section
2.2

REAL NUMBER
Free Flow
Emission Rate
Section 3.8

REAL
NUMBER
Source
Height
Always 1.
Section
4.3.3

REAL
NUMBER
Link Width
Section 2.6

Example 1

LINES 4 and 5B of Example 1

QUEUE LINK INPUT PART A

*Right and left turns are modeled as queue links

*If modeling a queue link line 5B and 5C are required

REAL NUMBER
X Coordinate of Beginning of Link
Section 2.2

REAL NUMBER
Y Coordinate of Beginning of Link
Section 2.2

INTEGER
TYPE OF LINK
"1" for Free Flow
"2" for Queue
Section 2.2-2.3

CHARACTER
Road Type
Section 2.1

REAL NUMBER
Source Height
Always 1.
Section 4.3.3

INTEGER
Number of lanes on link

2
'MAIN ST WB QUEUE'   'AG'   36. 6.   1000. 6.   1. 12. 1

CHARACTER
Link Name 20 Character Max

REAL NUMBER
Link Width
Section 2.6

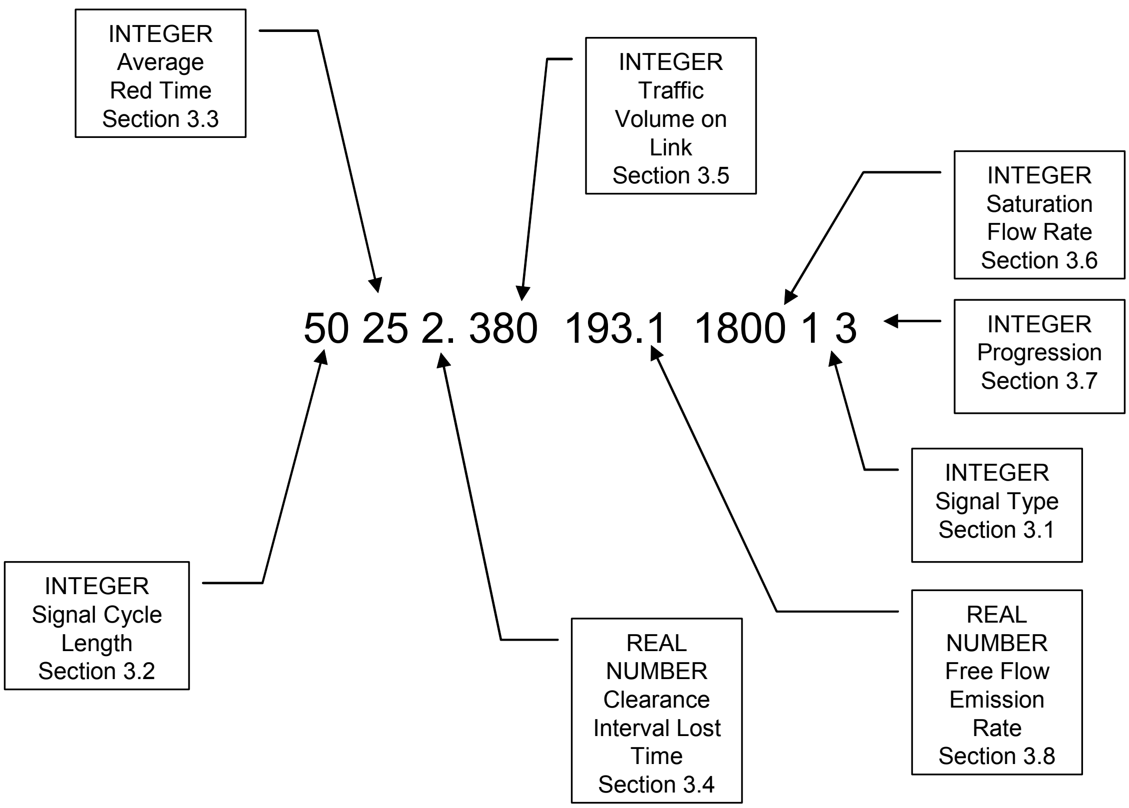
REAL NUMBER
X Coordinate of Ending of Link Section 2.2

REAL NUMBER
Y Coordinate of Beginning of Link
Section 2.2

Example 1

LINE 5C Example 1

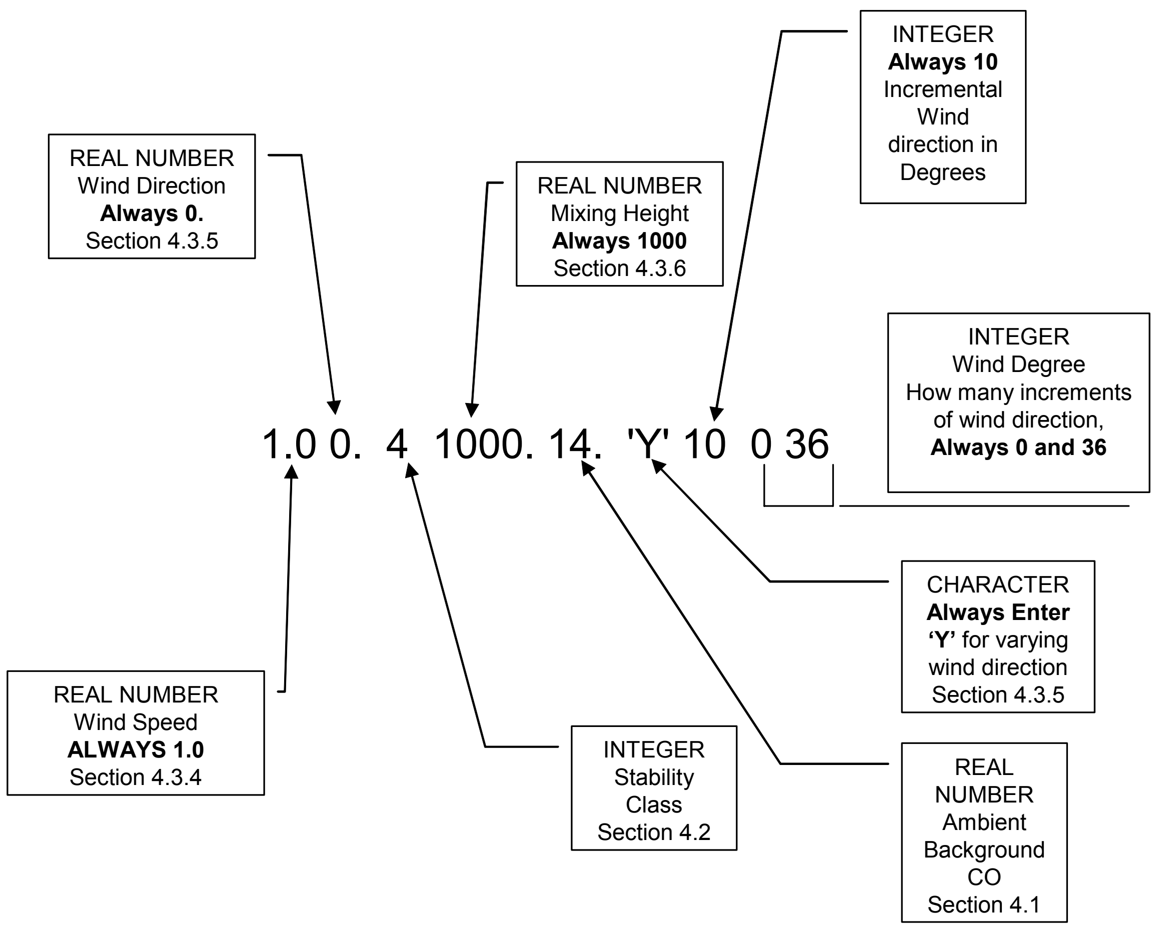
SIGNAL/TRAFFIC DATA INPUT



Example 1

LINE 6 of Example 1

METEOROLOGICAL INPUT



Example 1: CAL3QHC Output

```
                    CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                       PAGE  1

 JOB: 4-WAY                                                RUN: 1-LN EACH DIRECTION

 DATE :  4/28/ 3
 TIME : 12:36:34

    The MODE flag has been set to C for calculating CO averages.

  SITE & METEOROLOGICAL VARIABLES
  -------------------------------
  VS =    .0 CM/S      VD =    .0 CM/S      Z0 =  10. CM
   U =  1.0 M/S        CLAS =   5  (E)    ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  3.0 PPM

  LINK VARIABLES
  --------------
    LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                         *   X1        Y1        X2        Y2     *     (FT)  (DEG)             (G/MI)  (FT) (FT)       (VEH)
 ------------------------*----------------------------------------*--------------------------------------------------------------
  1. MAIN ST WB APPR.    *       .0       6.0    1000.0       6.0 *    1000.    90. AG    380.  15.8   1.0 32.0
  2. MAIN ST WB QUEUE    *     36.0       6.0      77.6       6.0 *      42.    90. AG    259. 100.0   1.0 12.0  .53   2.1
  3. MAIN ST WB DEP.     *       .0       6.0   -1000.0       6.0 *    1000.   270. AG    370.  15.8   1.0 32.0
  4. MAIN ST EB APPR.    *       .0      -6.0   -1000.0      -6.0 *    1000.   270. AG    300.  15.8   1.0 32.0
  5. MAIN ST EB QUEUE    *    -36.0      -6.0     -68.8      -6.0 *      33.   270. AG    259. 100.0   1.0 12.0  .42   1.7
  6. MAIN ST EB DEP.     *       .0      -6.0      -6.0   -1000.0 *     994.   180. AG    310.  15.8   1.0 32.0
  7. CENTER ST NB APPR.  *      6.0        .0       6.0   -1000.0 *    1000.   180. AG    300.  15.8   1.0 32.0
  8. CENTER ST NB QUEUE  *      6.0     -36.0       6.0     -68.8 *      33.   180. AG    259. 100.0   1.0 12.0  .63   1.7
  9. CENTER ST NB DEP.   *      6.0        .0       6.0    1000.0 *    1000.   360. AG    310.  15.8   1.0 32.0
 10. CENTER ST SB APPR.  *     -6.0        .0      -6.0    1000.0 *    1000.   360. AG    380.  15.8   1.0 12.0
 11. CENTER ST SB QUEUE  *     -6.0      36.0      -6.0      77.6 *      42.   360. AG    259. 100.0   1.0 12.0  .53   2.1
 12. CENTER ST SB DEP.   *     -6.0        .0      -6.0   -1000.0 *    1000.   180. AG    370.  15.8   1.0 12.0
```

Page 1 of output:
Lists link coordinates, and calculates the length of queue links. This page also shows the calculation for volume to capacity of the links.

Page 2 of output:
Lists the free flow link coordinates, signal timing as well as receptor locations

Example 1: CAL3QHC Output (cont.)

JOB: 4-WAY RUN: 1-LN EACH DIRECTION

DATE : 4/28/ 3
TIME : 12:36:34

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. MAIN ST WB QUEUE	40	20	2.0	380	1800	193.10	1	3
5. MAIN ST EB QUEUE	40	20	2.0	300	1800	193.10	1	3
8. CENTER ST NB QUEUE	40	20	2.0	300	1200	193.10	1	3
11. CENTER ST SB QUEUE	40	20	2.0	380	1800	193.10	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	322.0	22.0	6.0
2. REC 2	247.0	22.0	6.0
3. REC 3	172.0	22.0	6.0
4. REC 4	97.0	22.0	6.0
5. REC 5	22.0	22.0	6.0
6. REC 6	22.0	97.0	6.0
7. REC 7	22.0	172.0	6.0
8. REC 8	22.0	247.0	6.0
9. REC 9	22.0	322.0	6.0
10. REC 10	-22.0	322.0	6.0
11. REC 11	-22.0	247.0	6.0
12. REC 12	-22.0	172.0	6.0
13. REC 13	-22.0	97.0	6.0
14. REC 14	-22.0	22.0	6.0
15. REC 15	-97.0	22.0	6.0
16. REC 16	-172.0	22.0	6.0
17. REC 17	-247.0	22.0	6.0
18. REC 18	-322.0	22.0	6.0
19. REC 19	-322.0	-22.0	6.0
20. REC 20	-247.0	-22.0	6.0
21. REC 21	-172.0	-22.0	6.0
22. REC 22	-97.0	-22.0	6.0
23. REC 23	-22.0	-22.0	6.0
24. REC 24	-22.0	-97.0	6.0
25. REC 25	-22.0	-172.0	6.0
26. REC 26	-22.0	-247.0	6.0
27. REC 27	-22.0	-322.0	6.0
28. REC 28	22.0	-322.0	6.0

Example 1: CAL3QHC Output (cont.)

29. REC 29	22.0	-247.0	6.0
30. REC 30	22.0	-172.0	6.0
31. REC 31	22.0	-97.0	6.0
32. REC 32	22.0	-22.0	6.0

```
33. REC 33               *      97.0      -22.0       6.0   *
34. REC 34               *     172.0      -22.0       6.0   *
35. REC 35               *     247.0      -22.0       6.0   *
36. REC 36               *     322.0      -22.0       6.0   *
```

Example 1: CAL3QHC Output (cont.)

JOB: 4-WAY RUN: 1-LN EACH DIRECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	3.0	3.0	3.0	3.0	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.6	3.0	3.0	3.0	3.0	3.4	3.4
10.	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.7	3.7	3.7	3.7	4.1	3.2	3.1	3.0	3.0	3.4	3.4
20.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	4.3	3.2	3.2	3.2	3.0	3.4	3.6
30.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	4.3	3.2	3.2	3.2	3.1	3.5	3.6
40.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	4.1	3.2	3.2	3.2	3.0	3.4	3.6
50.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	3.7	3.2	3.2	3.0	3.0	3.4	3.4
60.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	3.5	3.4	3.2	3.0	3.0	3.5	3.5
70.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.3	3.3	3.3	3.3	3.5	3.3	3.0	3.0	3.6	3.7
80.	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.3	3.3	3.3	3.3	3.4	3.6	3.4	3.2	3.2	3.9	4.1
90.	3.5	3.5	3.5	3.5	3.6	3.0	3.0	3.0	3.0	3.3	3.3	3.3	3.3	4.1	3.8	3.8	4.0	3.8	3.6	3.8
100.	3.6	3.6	3.6	3.6	4.0	3.2	3.1	3.0	3.0	3.3	3.3	3.4	3.5	4.4	3.9	4.1	3.9	3.9	3.1	3.2
110.	3.4	3.4	3.4	3.4	4.2	3.2	3.1	3.1	3.0	3.3	3.4	3.4	3.5	4.0	4.2	3.8	3.7	3.6	3.0	3.0
120.	3.3	3.3	3.3	3.3	4.2	3.1	3.1	3.1	3.1	3.5	3.5	3.5	3.5	3.7	4.4	3.9	3.5	3.5	3.0	3.0
130.	3.3	3.3	3.3	3.3	4.0	3.1	3.1	3.1	3.1	3.5	3.5	3.5	3.7	3.7	4.4	3.8	3.6	3.5	3.0	3.1
140.	3.2	3.2	3.2	3.2	3.5	3.1	3.1	3.1	3.0	3.4	3.5	3.5	4.1	3.8	3.9	3.7	3.7	3.4	3.0	3.3
150.	3.2	3.2	3.2	3.2	3.3	3.3	3.1	3.1	3.1	3.5	3.5	3.6	4.4	4.1	3.6	3.6	3.6	3.3	3.0	3.3
160.	3.2	3.2	3.2	3.2	3.2	3.4	3.2	3.1	3.1	3.5	3.7	3.8	4.7	4.4	3.6	3.6	3.6	3.3	3.0	3.3
170.	3.2	3.2	3.2	3.2	3.3	3.4	3.3	3.3	3.2	4.2	4.0	4.2	4.6	4.6	3.6	3.5	3.3	3.3	3.0	3.0
180.	3.2	3.2	3.2	3.2	4.3	4.1	4.3	4.1	3.8	3.7	3.8	4.3	4.2	4.1	3.3	3.3	3.3	3.3	3.0	3.0
190.	3.2	3.2	3.5	3.5	4.8	4.2	4.1	4.0	4.0	3.0	3.2	3.3	3.4	3.3	3.3	3.3	3.3	3.3	3.0	3.0
200.	3.2	3.5	3.5	3.5	4.2	4.1	3.9	3.7	3.5	3.0	3.1	3.2	3.4	3.4	3.3	3.3	3.3	3.3	3.0	3.0
210.	3.2	3.5	3.5	3.5	3.8	4.4	3.8	3.6	3.5	3.0	3.1	3.2	3.3	3.7	3.3	3.3	3.3	3.3	3.0	3.0
220.	3.2	3.5	3.5	3.7	3.8	4.4	3.6	3.5	3.4	3.0	3.1	3.2	3.2	4.0	3.4	3.4	3.4	3.4	3.0	3.0
230.	3.3	3.3	3.6	4.2	3.8	4.0	3.6	3.6	3.5	3.1	3.2	3.2	3.2	4.1	3.5	3.5	3.5	3.5	3.0	3.0
240.	3.3	3.3	3.7	4.5	4.1	3.7	3.5	3.5	3.4	3.1	3.2	3.2	3.2	3.9	3.5	3.5	3.5	3.5	3.0	3.0
250.	3.4	3.5	3.7	4.8	4.3	3.5	3.5	3.5	3.3	3.0	3.2	3.2	3.2	3.7	3.6	3.6	3.6	3.6	3.0	3.0
260.	3.8	3.8	4.1	4.5	4.4	3.6	3.4	3.3	3.3	3.0	3.0	3.1	3.2	3.9	3.9	3.9	3.9	3.9	3.1	3.1
270.	3.8	3.9	4.1	4.1	4.0	3.3	3.3	3.3	3.3	3.0	3.0	3.0	3.0	3.7	3.7	3.7	3.7	3.7	3.6	3.6
280.	3.2	3.2	3.4	3.6	3.4	3.3	3.3	3.3	3.3	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.9	3.9
290.	3.0	3.0	3.3	3.4	3.4	3.3	3.3	3.3	3.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.6	3.6
300.	3.0	3.0	3.2	3.3	3.7	3.3	3.3	3.3	3.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5
310.	3.0	3.1	3.2	3.2	4.0	3.4	3.4	3.4	3.4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4
320.	3.0	3.2	3.2	3.2	4.0	3.4	3.4	3.4	3.4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4
330.	3.1	3.2	3.2	3.2	4.0	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4
340.	3.0	3.2	3.2	3.2	3.7	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4
350.	3.0	3.0	3.1	3.2	3.8	3.8	3.8	3.8	3.8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4
360.	3.0	3.0	3.0	3.0	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.6	3.0	3.0	3.0	3.0	3.4	3.4

Example 1: CAL3QHC Output (cont.)

```
------*---------------------------------------------------------------------------------------------------------------------------
MAX   *   3.8   3.9   4.1   4.8   4.8   4.4   4.3   4.1   4.0   4.2   4.0   4.3   4.7   4.6   4.4   4.1   4.0   3.9   3.9   4.1
DEGR. *  260   270   260   250   190   210   180   180   190   170   170   180   160   170   120   100    90  100    80    80
```

Example 1: CAL3QHC Output (cont.)

JOB: 4-WAY RUN: 1-LN EACH DIRECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	*	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36
	*	CONCENTRATION (PPM)															
0.	*	3.4	3.4	4.1	3.9	4.0	4.0	3.8	3.8	4.1	4.1	4.0	3.9	3.2	3.2	3.2	3.2
10.	*	3.6	3.6	4.6	4.3	4.3	4.2	4.3	3.2	3.3	3.3	3.5	3.3	3.2	3.2	3.2	3.2
20.	*	3.6	3.6	4.2	4.2	4.1	4.0	3.8	3.0	3.1	3.2	3.3	3.3	3.2	3.2	3.2	3.2
30.	*	3.6	3.6	4.0	4.4	3.8	3.7	3.7	3.1	3.1	3.1	3.2	3.6	3.2	3.2	3.2	3.2
40.	*	3.6	3.7	3.8	4.3	3.7	3.7	3.6	3.0	3.1	3.1	3.1	3.8	3.2	3.2	3.2	3.2
50.	*	3.6	4.0	3.9	4.0	3.7	3.7	3.7	3.1	3.1	3.1	3.1	3.8	3.2	3.2	3.2	3.2
60.	*	3.8	4.1	3.9	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.3
70.	*	4.0	4.6	4.2	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.3
80.	*	4.1	4.3	4.2	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.4
90.	*	3.8	3.9	3.9	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.2
100.	*	3.5	3.6	3.4	3.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
110.	*	3.3	3.5	3.6	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
120.	*	3.3	3.4	3.9	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
130.	*	3.3	3.3	4.2	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
140.	*	3.3	3.3	4.2	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
150.	*	3.3	3.3	4.0	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0
160.	*	3.3	3.3	3.9	3.8	3.8	3.8	3.8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
170.	*	3.2	3.3	4.1	4.1	4.1	4.1	4.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0
180.	*	3.0	3.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.9	3.0	3.0	3.0	3.0
190.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.1	4.2	4.2	4.2	4.4	3.3	3.1	3.0	3.0
200.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.8	3.8	3.8	3.8	4.5	3.3	3.3	3.3	3.0
210.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.7	3.7	3.7	3.7	4.6	3.3	3.3	3.3	3.0
220.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.6	3.6	3.6	3.6	4.3	3.3	3.3	3.3	3.0
230.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.8	3.3	3.3	3.0	3.0
240.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.6	3.4	3.3	3.0	3.0
250.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	3.5	3.5	3.3	3.0	3.0
260.	*	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	3.5	3.5	3.4	3.1	3.0
270.	*	3.6	3.6	3.6	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	4.3	3.9	3.8	3.7	3.4
280.	*	3.9	3.9	4.1	3.2	3.2	3.0	3.0	3.4	3.4	3.6	3.6	4.7	3.8	3.8	3.7	3.7
290.	*	3.6	3.6	4.3	3.2	3.2	3.2	3.0	3.4	3.6	3.6	3.6	4.2	3.8	3.7	3.4	3.3
300.	*	3.5	3.5	4.4	3.2	3.2	3.2	3.1	3.6	3.7	3.7	3.7	3.8	4.2	3.6	3.3	3.3
310.	*	3.4	3.4	4.1	3.2	3.2	3.2	3.1	3.6	3.7	3.7	3.8	3.9	4.2	3.4	3.3	3.2
320.	*	3.4	3.4	3.7	3.2	3.2	3.1	3.0	3.6	3.7	3.8	4.2	3.6	3.9	3.4	3.4	3.2
330.	*	3.4	3.4	3.5	3.3	3.2	3.1	3.0	3.7	3.8	4.0	4.3	3.7	3.6	3.4	3.4	3.3
340.	*	3.4	3.4	3.4	3.4	3.3	3.1	3.0	3.8	4.0	4.1	4.7	4.1	3.4	3.4	3.4	3.2
350.	*	3.4	3.4	3.4	3.4	3.3	3.2	3.0	4.1	4.3	4.2	4.6	4.2	3.4	3.4	3.2	3.2
360.	*	3.4	3.4	4.1	3.9	4.0	4.0	3.8	3.8	4.1	4.1	4.0	3.9	3.2	3.2	3.2	3.2

Example 1: CAL3QHC Output (cont.)

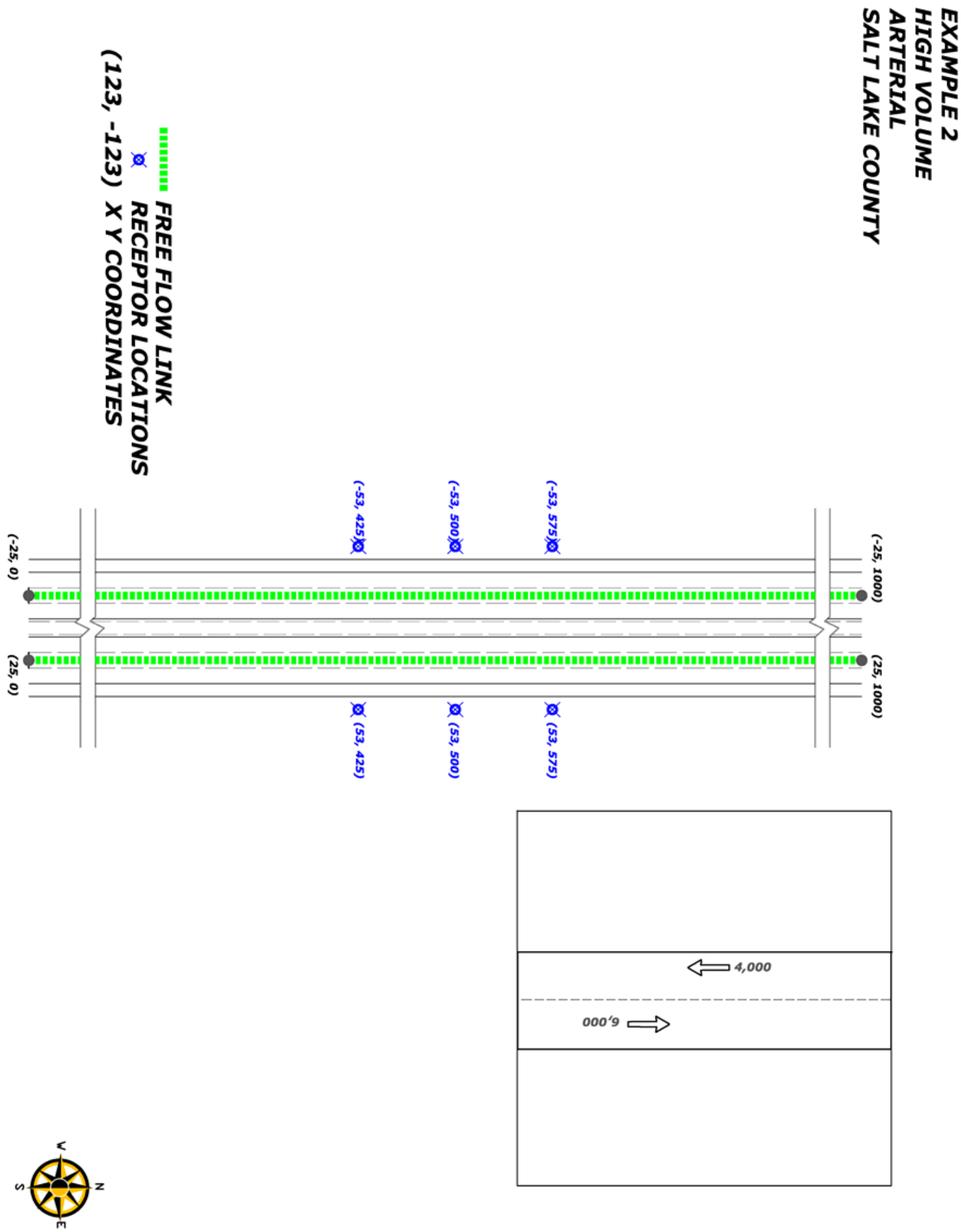
Pages 3 and 4 of output describe the receptor CO concentration in ppm based on the wind direction. Page 4 is the final page of the report and gives you the highest level of CO recorded for a 1-hour model and which receptor the highest value was recorded at.

```
------*-----------------------------------------------------------------------------------------
MAX   *   4.1   4.6   4.6   4.4   4.3   4.2   4.3   4.1   4.3   4.2   4.7   4.7   4.2   3.8   3.7   3.7
DEGR. *   80    70    10    30    10    10    10   350   350   190   340   280   300   270   270   280

THE HIGHEST CONCENTRATION OF    4.80 PPM OCCURRED AT RECEPTOR REC5 .
```

5.2 Example 2: High Volume Arterial, Salt Lake County

Because CAL3QHC uses the same algorithms that CALINE 3 uses to determine the CO concentrations along free flow traffic roadways, CAL3QHC can also be used to model free flow CO concentrations along roadways without intersections. This arterial section has three 12 foot travel lanes in each direction and 14 foot center median.



Example 2: High Volume Arterial, Salt Lake County

CAL3QHC Input:

```
'3LN-ARTERIAL'  60. 108.  0.  0.  6   0.3048 1 1
'REC 1'          53.    575.    6.
'REC 2'          53.    500.    6.
'REC 3'          53.    425.    6.
'REC 4'         -53.    425.    6.
'REC 5'         -53.    500.    6.
'REC 6'         -53.    575.    6.
'10,000 VEH/HR'    2  1  0  'C'
1
'ARTERIAL NB.'    'AG'    25.   0.   25.  1000.  6000.   12.3    1. 56.
1
'ARTERIAL SB.'    'AG'   -25.   0.  -25.  1000.  4000.   12.3    1. 56.
1.0 0.  5  1000. 12.  'Y' 10  0 36
```

Example 2: CAL3QHC Output

```
             CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

JOB: 3LN-ARTERIAL                                          RUN: 10,000 VEH/HR

DATE :  4/29/ 3
TIME : 21: 2:12

   The MODE flag has been set to C for calculating CO averages.

 SITE & METEOROLOGICAL VARIABLES
 -------------------------------
 VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 175. CM
  U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 12.0 PPM

 LINK VARIABLES
 --------------
   LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                        *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT)  (FT)       (VEH)
------------------------*----------------------------------------*--------------------------------------------------------------
 1. ARTERIAL NB.        *     25.0        .0      25.0    1000.0 *    1000.   360. AG   6000.  12.3   1.0 56.0
 2. ARTERIAL SB.        *    -25.0        .0     -25.0    1000.0 *    1000.   360. AG   4000.  12.3   1.0 56.0
```

Example 2: CAL3QHC Output (cont.)

```
             CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

 JOB: 3LN-ARTERIAL                                         RUN: 10,000 VEH/HR

 DATE :  4/29/ 3
 TIME : 21: 2:12

    The MODE flag has been set to C for calculating CO averages.

  SITE & METEOROLOGICAL VARIABLES
  -------------------------------
  VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 175. CM
   U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 12.0 PPM

  LINK VARIABLES
  --------------
    LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                         *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT) (FT)       (VEH)
 ------------------------*----------------------------------------*--------------------------------------------------------------
  1. ARTERIAL NB.        *     25.0        .0      25.0    1000.0 *    1000.   360. AG   6000.  12.3   1.0 56.0
  2. ARTERIAL SB.        *    -25.0        .0     -25.0    1000.0 *    1000.   360. AG   4000.  12.3   1.0 56.0
```

Example 2: CAL3QHC Output (cont.)

```
                                                                                    PAGE  3
     JOB: 3LN-ARTERIAL                                          RUN: 10,000 VEH/HR

      MODEL RESULTS
      -------------

      REMARKS : In search of the angle corresponding to
                the maximum concentration, only the first
                angle, of the angles with same maximum
                concentrations, is indicated as maximum.

 WIND ANGLE RANGE:   0.-360.

 WIND  * CONCENTRATION
 ANGLE *      (PPM)
 (DEGR)* REC1  REC2  REC3  REC4  REC5  REC6
 ------*------------------------------------
   0.  *  15.7  16.0  16.2  15.1  14.9  14.7
  10.  *  13.5  13.7  13.7  16.8  16.5  16.2
  20.  *  12.5  12.5  12.6  16.7  16.6  16.5
  30.  *  12.3  12.3  12.3  16.1  16.1  16.0
  40.  *  12.2  12.2  12.2  15.7  15.7  15.7
  50.  *  12.2  12.2  12.2  15.2  15.2  15.2
  60.  *  12.1  12.1  12.1  15.0  15.0  15.0
  70.  *  12.1  12.1  12.1  14.9  14.9  14.9
  80.  *  12.0  12.0  12.0  14.9  14.9  14.9
  90.  *  12.0  12.0  12.0  15.0  15.0  15.0
 100.  *  12.0  12.0  12.0  14.9  14.9  14.9
 110.  *  12.1  12.1  12.1  14.9  14.9  14.9
 120.  *  12.1  12.1  12.1  15.0  15.0  15.0
 130.  *  12.2  12.2  12.2  15.2  15.2  15.2
 140.  *  12.2  12.2  12.2  15.7  15.7  15.7
 150.  *  12.3  12.3  12.3  16.0  16.1  16.1
 160.  *  12.6  12.5  12.5  16.5  16.6  16.7
 170.  *  13.7  13.7  13.5  16.2  16.5  16.8
 180.  *  16.2  16.0  15.7  14.7  14.9  15.1
 190.  *  17.8  17.5  17.3  13.1  13.1  13.2
 200.  *  17.4  17.4  17.2  12.4  12.4  12.4
 210.  *  16.6  16.6  16.6  12.2  12.2  12.2
 220.  *  16.0  16.0  16.0  12.2  12.2  12.2
 230.  *  15.6  15.6  15.6  12.1  12.1  12.1
 240.  *  15.3  15.3  15.3  12.1  12.1  12.1
 250.  *  15.2  15.2  15.2  12.0  12.0  12.0
 260.  *  15.1  15.1  15.1  12.0  12.0  12.0
 270.  *  15.3  15.3  15.3  12.0  12.0  12.0
 280.  *  15.1  15.1  15.1  12.0  12.0  12.0
 290.  *  15.2  15.2  15.2  12.0  12.0  12.0
 300.  *  15.3  15.3  15.3  12.1  12.1  12.1
 310.  *  15.6  15.6  15.6  12.1  12.1  12.1
 320.  *  16.0  16.0  16.0  12.2  12.2  12.2
```

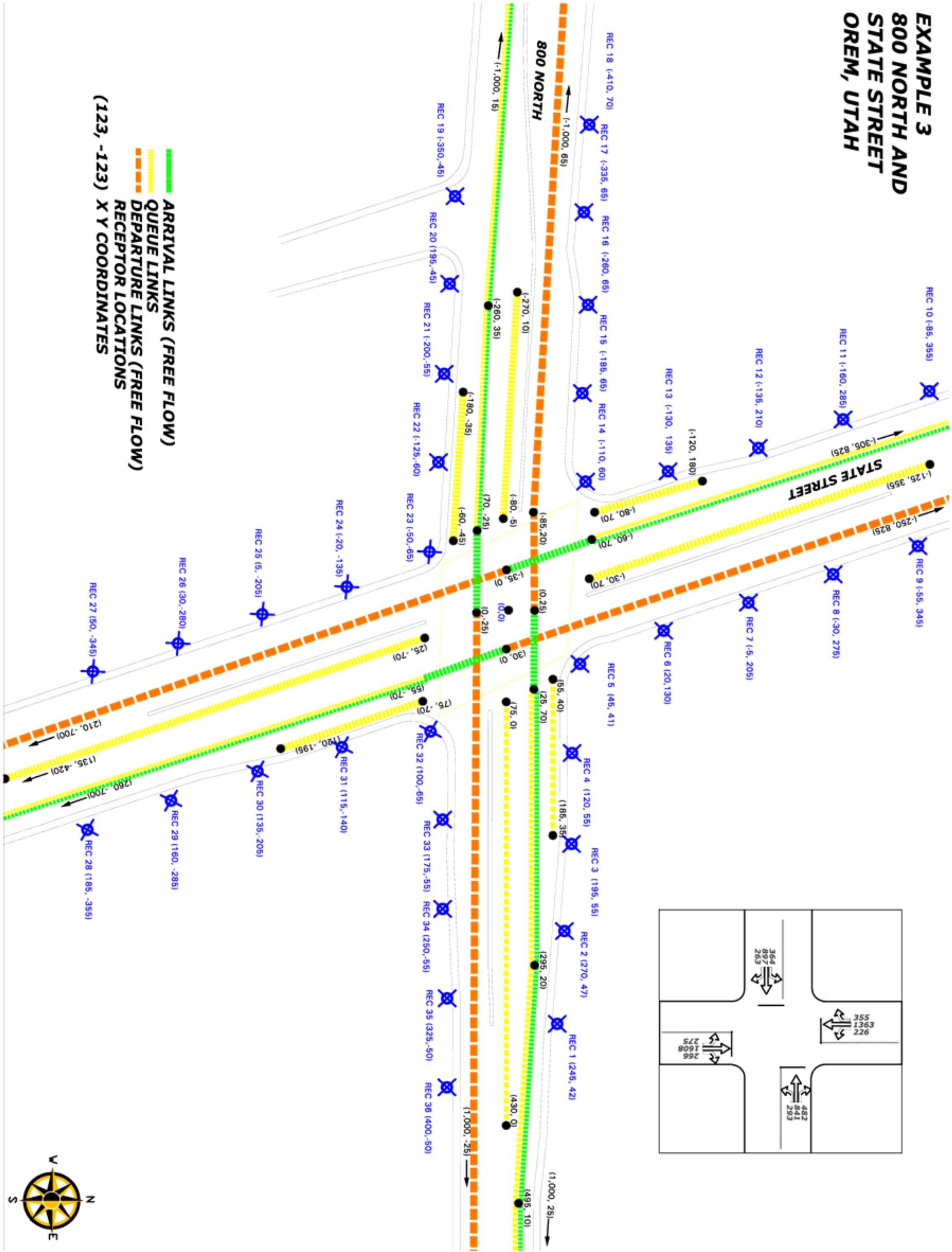
Example 2: CAL3QHC Output (cont.)

```
330.  *  16.6  16.6  16.6  12.2  12.2  12.2
340.  *  17.2  17.4  17.4  12.4  12.4  12.4
350.  *  17.3  17.5  17.8  13.2  13.1  13.1
360.  *  15.7  16.0  16.2  15.1  14.9  14.7
------*-----------------------------------
MAX   *  17.8  17.5  17.8  16.8  16.6  16.8
DEGR. *  190   190   350    10    20   170

THE HIGHEST CONCENTRATION OF   17.80 PPM OCCURRED AT RECEPTOR REC1 .
```

5.3 Example 3: Complex Intersection (Dual Lefts & Rights, Orem), UT

This example is the intersection of 800 North and State Street in Orem, Utah as it exists in 2003. This is an example of a complex intersection with dual lefts and right turn lanes.



Example 3: Complex Intersection

CAL3QHC Input:

```
'800 North State Street Intersection' 60. 175.  0.  0.  36   0.3048 1 1
'REC  1'    345.     42.      6.
'REC  2'    270.     47.      6.
'REC  3'    195.     55.      6.
'REC  4'    120.     55.      6.
'REC  5'     45.     41.      6.
'REC  6'     20.    130.      6.
'REC  7'     -5.    205.      6.
'REC  8'    -30.    275.      6.
'REC  9'    -55.    345.      6.
'REC 10'    -85.    355.      6.
'REC 11'   -160.    285.      6.
'REC 12'   -135.    210.      6.
'REC 13'   -120.    135.      6.
'REC 14'   -110.     60.      6.
'REC 15'   -185.     65.      6.
'REC 16'   -260.     65.      6.
'REC 17'   -335.     65.      6.
'REC 18'   -410.     70.      6.
'REC 19'   -350.    -45.      6.
'REC 20'   -275.    -50.      6.
'REC 21'   -200.    -55.      6.
'REC 22'   -125.    -60.      6.
'REC 23'    -50.    -65.      6.
'REC 24'    -20.   -135.      6.
'REC 25'      5.   -205.      6.
'REC 26'     30.   -280.      6.
'REC 27'     50.   -345.      6.
'REC 28'    185.   -355.      6.
'REC 29'    160.   -285.      6.
'REC 30'    135.   -205.      6.
'REC 31'    115.   -140.      6.
'REC 32'    100.    -65.      6.
'REC 33'    175.    -55.      6.
'REC 34'    250.    -55.      6.
'REC 35'    325.    -50.      6.
'REC 36'    400.    -50.      6.
'800 N Existing'    26  1  0  'C'
1
'State St. NB Appr.'   'AG'   260.    -700.     30.    0.    1608.  14.6    1.     56.
2
'State St. NB Queue'   'AG'    55.     -70.    260.  -700.      1.  36.     3
       100 60 2. 1608 146.5 1800 1 3
1
'State St. NB Dep'     'AG'    30.       0.   -250.   825.    2454.  14.6    1.     56.
2
'State St. NB L.Queue' 'AG'    25.     -70.    135.   420.      1.  24.     2
       100 86 2. 275 146.5 1800 1 3
2
'State St NB R. Queue' 'AG'    75.     -70.      1.   32.       1   12.     1
       100 10 2. 266 146.5 1800 1 3
1
'State St .SB Appr.'   'AG'  -305.     825.    -35.    0.    1363.   14.6    1.    56.
```

Example 3: Complex Intersection
CAL3QHC Input (cont.)

```
2
'State St. SB Queue'   'AG'   -60.      70.    -305.  825.       1.  36.     3
       100 59 2. 1363 146.5 1800 1 3
1
'State St. SB Dep.   '  'AG'  -35.       0.     210. -700.     1919.   14.6      1.   56.
2
'State St. SB L.Queue'  'AG'  -30.      70.    -125.  355.       1.  24.      2
         100 85 2.   355 146.5  1800   1    3
2
'State St. SB R. Queue'  'AG' -80.      75.    -120.  180.       1.  32.      1
         100 10  2.  226 146.5  1800 1 3
1
'800 N. EB Appr1.'  'AG'     -1000.      15.   -260.   35.      897.   14.6      1.  44.
1
'800 N. EB Appr2.'  'AG'      -260.      35.     70.   25.      897.   14.6      1.  44.
1
'800 N. EB Appr3.'  'AG'       70.       25.      0.   25.      897.   14.6      1.  44.
2
'800 N. EB Queue'   'AG'       70.      -25.    260.   35.        1.   36.       2
       100 68 2. 897 146.5 1800 1 3
1
'800 N EB Dep'      'AG'        0.      25.    1000.  -25.     1389.   14.6      1.  44.
2
 '800 N. EB LQueue' 'AG'       -5.     -80.    -270.   10.        1.   24.       2
       100 15 2. 364 146.5 1800 1 3
2
 '800 N EB R. Queue' 'AG'      60.     -45.    -180.  -35.        1.   12.       1
        90 10 2. 263 146.5   1800 1 3
1
'800 N. WB Appr1'    'AG'    1000.      25.       0.   25.      841.   14.6      1.  44.
1
'800 N. WB Appr2'    'AG'       0.      25.     495.   10.      841.   14.6      1.  44.
1
'800 N. WB Appr3'    'AG'     495.      10.     295.   20.      841.   14.6      1.  44.
1
'800 N. WB Appr4'    'AG'     295.      20.       0.   25.      841.   14.6      1.  44.
2
'800 N. WB Queue  '  'AG'      25.      70.    1000.   25.        1.   42.       2
       100 22 2. 841 146.5 1900 1 3
1
'800 N WB Dep1'      'AG'     -25.      70.    -85.    20.     1471.   14.6      1.  44.
1
'800 N WB Dep2'      'AG'     -85.      20.     65.  1000.     1471.   14.6      1.  44.
2
'800 N. WB L. Queue' 'AG'      75.       0.    430.     0.        1.   24.       2
       100 87 2. 293 146.5 1900 1 3
 2
 '800 N WB R. Queue' 'AG'      55.      40.    185.    35.        1.   12.       1
       100 10 2. 482 146.5 1900 1 3
 1.0 00. 5 1000. 14.  'Y' 10  0 361
```

:

Example 3: CAL3QHC Output

```
                         CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                       PAGE  1

 JOB: 800 North State Street Intersection                  RUN: 800 N Existing

 DATE :  4/29/ 3
 TIME : 21: 2:12

    The MODE flag has been set to C for calculating CO averages.

  SITE & METEOROLOGICAL VARIABLES
  -------------------------------
  VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 175. CM
   U =  1.0 M/S         CLAS =   5  (E)      ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 14.0 PPM

  LINK VARIABLES
  --------------
    LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                         *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT)  (FT)       (VEH)
 ------------------------*----------------------------------------*-------------------------------------------------------------
  1. State St. NB Appr.  *    260.0    -700.0      30.0        .0 *     737.   342. AG   1608.  14.6   1.0 56.0
  2. State St. NB Queue  *     55.0     -70.0     113.5    -249.7 *     189.   162. AG    707. 100.0   1.0 36.0  .83    9.6
  3. State St. NB Dep    *     30.0        .0    -250.0     825.0 *     871.   341. AG   2454.  14.6   1.0 56.0
  4. State St. NB L.Queue*     25.0     -70.0      41.2       2.2 *      74.    13. AG    676. 100.0   1.0 24.0  .76    3.8
  5. State St NB R. Queue*     75.0     -70.0      66.5     -58.2 *      15.   324. AG     39. 100.0   1.0 12.0  .17     .7
  6. State St .SB Appr.  *   -305.0     825.0     -35.0        .0 *     868.   162. AG   1363.  14.6   1.0 56.0
  7. State St. SB Queue  *    -60.0      70.0    -105.2     209.3 *     146.   342. AG    696. 100.0   1.0 36.0  .68    7.4
  8. State St. SB Dep.   *    -35.0        .0     210.0    -700.0 *     742.   161. AG   1919.  14.6   1.0 56.0
  9. State St. SB L.Queue*    -30.0      70.0     -65.7     177.0 *     113.   342. AG    668. 100.0   1.0 24.0  .89    5.7
 10. State St. SB R. Queu*    -80.0      75.0     -84.4      86.5 *      12.   339. AG     39. 100.0   1.0 32.0  .15     .6
 11. 800 N. EB Appr1.    *  -1000.0      15.0    -260.0      35.0 *     740.    88. AG    897.  14.6   1.0 44.0
 12. 800 N. EB Appr2.    *   -260.0      35.0      70.0      25.0 *     330.    92. AG    897.  14.6   1.0 44.0
 13. 800 N. EB Appr3.    *     70.0      25.0        .0      25.0 *      70.   270. AG    897.  14.6   1.0 44.0
 14. 800 N. EB Queue     *     70.0     -25.0     261.5      35.5 *     201.    72. AG    534. 100.0   1.0 36.0  .89   10.2
 15. 800 N EB Dep        *       .0      25.0    1000.0     -25.0 *    1001.    93. AG   1389.  14.6   1.0 44.0
 16. 800 N. EB LQueue    *     -5.0     -80.0     -19.1     -75.2 *      15.   289. AG    118. 100.0   1.0 24.0  .12     .8
 17. 800 N EB R. Queue   *     60.0     -45.0      45.6     -44.4 *      14.   272. AG     44. 100.0   1.0 12.0  .17     .7
 18. 800 N. WB Appr1     *   1000.0      25.0        .0      25.0 *    1000.   270. AG    841.  14.6   1.0 44.0
 19. 800 N. WB Appr2     *       .0      25.0     495.0      10.0 *     495.    92. AG    841.  14.6   1.0 44.0
 20. 800 N. WB Appr3     *    495.0      10.0     295.0      20.0 *     200.   273. AG    841.  14.6   1.0 44.0
 21. 800 N. WB Appr4     *    295.0      20.0        .0      25.0 *     295.   271. AG    841.  14.6   1.0 44.0
 22. 800 N. WB Queue     *     25.0      70.0      75.5      67.7 *      51.    93. AG    173. 100.0   1.0 42.0  .30    2.6
 23. 800 N WB Dep1       *    -25.0      70.0     -85.0      20.0 *      78.   230. AG   1471.  14.6   1.0 44.0
 24. 800 N WB Dep2       *    -85.0      20.0      65.0    1000.0 *     991.     9. AG   1471.  14.6   1.0 44.0
 25. 800 N. WB L. Queue  *     75.0        .0     165.8        .0 *      91.    90. AG    684. 100.0   1.0 24.0  .85    4.6
 26. 800 N WB R. Queue   *     55.0      40.0      81.3      39.0 *      26.    92. AG     39. 100.0   1.0 12.0  .29    1.3
```

JOB: 800 North State Street Intersection RUN: 800 N Existing

DATE : 4/29/ 3
TIME : 21: 2:12

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. State St. NB Queue	100	60	2.0	1608	1800	146.50	1	3
4. State St. NB L.Queue	100	86	2.0	275	1800	146.50	1	3
5. State St NB R. Queue	100	10	2.0	266	1800	146.50	1	3
7. State St. SB Queue	100	59	2.0	1363	1800	146.50	1	3
9. State St. SB L.Queue	100	85	2.0	355	1800	146.50	1	3
10. State St. SB R. Queu	100	10	2.0	226	1800	146.50	1	3
14. 800 N. EB Queue	100	68	2.0	897	1800	146.50	1	3
16. 800 N. EB LQueue	100	15	2.0	364	1800	146.50	1	3
17. 800 N EB R. Queue	90	10	2.0	263	1800	146.50	1	3
22. 800 N. WB Queue	100	22	2.0	841	1900	146.50	1	3
25. 800 N. WB L. Queue	100	87	2.0	293	1900	146.50	1	3
26. 800 N WB R. Queue	100	10	2.0	482	1900	146.50	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	345.0	42.0	6.0
2. REC 2	270.0	47.0	6.0
3. REC 3	195.0	55.0	6.0
4. REC 4	120.0	55.0	6.0
5. REC 5	45.0	41.0	6.0
6. REC 6	20.0	130.0	6.0
7. REC 7	-5.0	205.0	6.0
8. REC 8	-30.0	275.0	6.0
9. REC 9	-55.0	345.0	6.0
10. REC 10	-85.0	355.0	6.0
11. REC 11	-160.0	282.0	6.0
12. REC 12	-135.0	212.0	6.0
13. REC 13	-120.0	115.0	6.0
14. REC 14	-110.0	70.0	6.0
15. REC 15	-185.0	65.0	6.0
16. REC 16	-260.0	65.0	6.0
17. REC 17	-335.0	65.0	6.0
18. REC 18	-410.0	70.0	6.0
19. REC 19	-350.0	-45.0	6.0
20. REC 20	-275.0	-50.0	6.0

Example 3: CAL3QHC Output (cont.)

```
    21. REC 21              *     -200.0      -55.0        6.0   *
    22. REC 22              *     -125.0      -60.0        6.0   *
    23. REC 23              *      -50.0      -65.0        6.0   *
    24. REC 24              *      -20.0     -135.0        6.0   *
    25. REC 25              *        5.0     -205.0        6.0   *
    26. REC 26              *       30.0     -280.0        6.0   *
    27. REC 27              *       50.0     -345.0        6.0   *
    28. REC 28              *      185.0     -355.0        6.0   *
    29. REC 29              *      160.0     -285.0        6.0   *
    30. REC 30              *      135.0     -205.0        6.0   *
    31. REC 31              *      115.0     -140.0        6.0   *
    32. REC 32              *      100.0      -65.0        6.0   *
    33. REC 33              *      175.0      -55.0        6.0   *
```

Example 3: CAL3QHC Output (cont.)


```
 JOB: 800 North State Street Intersection                 RUN: 800 N Existing

 DATE :  4/29/ 3
 TIME : 21: 2:12


  RECEPTOR LOCATIONS
  ------------------
                         *          COORDINATES (FT)          *
    RECEPTOR             *      X          Y          Z        *
-------------------------*-------------------------------------*
34. REC 34               *       250.0      -55.0        6.0   *
35. REC 35               *       325.0      -50.0        6.0   *
36. REC 36               *       400.0      -50.0        6.0   *
```

Example 3: CAL3QHC Output (cont.)

PAGE 4

JOB: 800 North State Street Intersection RUN: 800 N Existing

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	*	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	*	CONCENTRATION (PPM)																			
0.	*	14.0	14.0	14.1	14.1	15.1	14.6	14.8	16.0	15.0	15.6	15.9	16.2	16.6	17.0	14.8	14.4	14.2	14.0	14.4	14.6
10.	*	14.0	14.0	14.0	14.0	14.8	14.3	14.5	15.7	15.6	15.5	15.8	16.0	17.3	18.2	15.1	14.8	14.4	14.2	14.6	14.8
20.	*	14.0	14.0	14.0	14.0	14.6	14.1	14.2	15.0	15.7	15.5	15.9	16.1	17.9	18.8	15.5	14.9	14.6	14.5	14.8	15.0
30.	*	14.0	14.0	14.0	14.0	14.8	14.1	14.0	14.5	15.4	15.4	15.8	16.0	18.0	18.9	15.9	14.9	14.7	14.7	14.9	15.4
40.	*	14.1	14.0	14.0	14.0	14.9	14.0	14.0	14.2	15.1	15.3	15.7	15.8	18.2	18.7	16.1	15.1	14.7	14.7	15.2	15.7
50.	*	14.1	14.0	14.0	14.0	14.9	14.0	14.0	14.1	14.9	15.2	15.7	15.8	18.2	18.5	16.4	15.3	14.8	14.7	15.5	16.0
60.	*	14.1	14.1	14.0	14.0	14.9	14.0	14.0	14.1	14.8	15.1	15.5	15.6	18.3	18.4	16.6	15.7	15.1	14.8	15.7	15.7
70.	*	14.2	14.1	14.0	14.0	15.3	14.0	14.0	14.1	14.7	15.1	15.5	15.7	18.3	18.4	16.6	15.8	15.5	15.2	15.7	16.1
80.	*	14.8	14.6	14.4	14.5	16.8	14.0	14.0	14.1	14.7	15.1	15.5	15.9	18.3	18.4	16.9	16.2	15.9	15.6	16.4	16.5
90.	*	15.9	15.7	15.7	16.0	19.6	14.2	14.0	14.0	14.7	15.1	15.6	16.5	18.8	19.2	17.9	17.0	16.7	16.4	15.9	16.1
100.	*	16.8	16.9	17.1	17.5	20.9	14.8	14.2	14.3	14.7	15.1	15.8	17.4	20.0	19.9	18.3	17.5	17.0	16.5	15.0	15.2
110.	*	17.0	16.9	17.6	17.9	20.9	15.4	14.8	14.4	15.0	15.4	16.2	18.9	20.9	19.3	17.5	16.6	15.8	15.7	14.7	14.9
120.	*	16.6	16.5	17.7	17.5	20.3	15.7	15.1	14.8	15.2	15.7	16.7	20.2	20.0	18.6	16.5	15.6	15.5	15.2	14.6	14.7
130.	*	16.2	16.2	17.4	17.4	19.8	16.2	15.4	14.9	15.4	15.9	17.7	21.5	19.2	17.9	16.0	15.5	15.2	15.0	14.5	14.6
140.	*	16.1	16.1	17.2	17.6	19.1	16.4	15.6	15.2	15.9	16.8	19.3	21.9	17.9	17.9	15.6	15.1	14.9	14.7	14.3	14.4
150.	*	15.8	15.8	17.1	17.9	18.9	17.2	16.0	15.9	16.7	18.3	19.5	20.7	17.4	17.2	15.2	14.7	14.5	14.4	14.0	14.1
160.	*	15.8	15.7	16.7	17.7	20.2	18.3	17.6	17.7	18.3	19.7	17.9	18.4	16.0	15.9	14.7	14.4	14.4	14.3	14.0	14.0
170.	*	15.7	15.6	16.9	18.5	21.7	19.4	18.4	19.0	19.9	20.0	15.3	15.5	14.7	14.9	14.4	14.4	14.4	14.3	14.0	14.0
180.	*	15.9	16.2	17.4	19.7	21.5	18.9	17.8	18.9	19.8	18.6	14.3	14.4	14.3	14.4	14.4	14.4	14.4	14.3	14.0	14.0
190.	*	16.1	16.6	17.8	19.7	21.0	17.3	17.5	19.4	18.8	17.2	14.2	14.2	14.2	14.3	14.4	14.4	14.4	14.3	14.0	14.0
200.	*	16.1	17.2	18.4	19.5	20.0	16.4	18.1	19.3	17.2	16.1	14.2	14.2	14.2	14.3	14.4	14.3	14.4	14.3	14.0	14.0
210.	*	16.3	18.0	19.5	19.2	19.1	16.6	18.5	18.4	16.2	15.5	14.1	14.2	14.2	14.4	14.4	14.4	14.4	14.4	14.0	14.0
220.	*	16.6	18.6	19.9	18.9	18.7	17.0	18.4	17.6	15.8	15.5	14.1	14.2	14.2	14.4	14.4	14.4	14.4	14.4	14.0	14.0
230.	*	17.2	19.5	19.9	18.0	18.5	17.5	18.3	16.9	15.6	15.3	14.1	14.2	14.3	14.4	14.5	14.5	14.5	14.4	14.0	14.0
240.	*	17.9	20.9	19.5	17.8	18.7	18.0	17.8	16.5	15.6	15.3	14.1	14.2	14.4	14.4	14.6	14.6	14.6	14.5	14.0	14.0
250.	*	19.0	21.8	18.7	17.9	18.9	18.3	17.5	16.2	15.7	15.3	14.1	14.2	14.4	14.6	14.7	14.7	14.7	14.6	14.0	14.0
260.	*	20.1	21.2	17.9	17.7	19.0	18.2	16.9	16.1	15.5	15.2	14.0	14.1	14.3	14.7	14.7	14.7	14.7	14.5	14.0	14.0
270.	*	19.1	19.1	16.7	17.3	19.3	18.1	16.5	16.1	15.4	15.2	14.0	14.0	14.1	14.4	14.5	14.5	14.4	14.3	14.1	14.1
280.	*	16.9	17.3	16.4	16.7	18.9	18.1	16.3	16.2	15.5	15.3	14.0	14.0	14.0	14.1	14.1	14.1	14.1	14.1	14.3	14.3
290.	*	15.3	15.8	15.9	16.7	18.8	18.0	16.2	16.3	15.6	15.4	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.3	14.3
300.	*	14.8	15.2	15.4	16.5	19.0	17.4	16.2	16.4	15.8	15.6	14.0	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.3	14.3

Example 3: CAL3QHC Output (cont.)

```
 310.  *  14.8  14.8  15.0  15.9  19.5  16.9  16.4  16.6  16.1  16.0  14.0  14.1  14.0  14.0  14.0  14.0  14.0  14.0  14.3  14.3
 320.  *  14.7  14.8  14.9  15.5  19.3  16.9  16.9  17.1  16.5  16.4  14.1  14.1  14.0  14.0  14.0  14.0  14.0  14.0  14.3  14.2
330.  *  14.3  14.5  14.7  15.2  18.8  17.0  17.1  17.4  16.6  17.0  14.3  14.3  14.1  14.1  14.0  14.0  14.0  14.0  14.2  14.2
 340.  *  14.1  14.2  14.3  14.7  17.6  16.4  16.5  16.9  16.0  17.1  14.9  15.1  14.6  14.7  14.1  14.0  14.0  14.0  14.2  14.2
 350.  *  14.0  14.1  14.2  14.4  16.0  15.2  15.4  16.1  15.0  16.4  15.8  15.9  15.5  15.7  14.4  14.2  14.0  14.0  14.2  14.3
 360.  *  14.0  14.0  14.1  14.1  15.1  14.6  14.8  16.0  15.0  15.6  15.9  16.2  16.6  17.0  14.8  14.4  14.2  14.0  14.4  14.6
 ------*------------------------------------------------------------------------------------------------------------------------
 MAX   *  20.1  21.8  19.9  19.7  21.7  19.4  18.5  19.4  19.9  20.0  19.5  21.9  20.9  19.9  18.3  17.5  17.0  16.5  16.4  16.5
 DEGR. *  260   250   230   180   170   170   210   190   170   170   150   140   110   100   100   100   100   100    80    80
```

Example 3: CAL3QHC Output (cont.)

JOB: 800 North State Street Intersection RUN: 800 N Existing

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR) * CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36
0.	14.8	16.1	19.0	18.2	18.5	18.3	18.4	15.0	15.3	15.5	16.0	17.4	16.5	15.7	15.0	15.0
10.	15.3	17.3	17.6	17.5	18.0	18.0	18.1	14.6	15.0	15.3	15.8	17.5	16.2	15.4	15.0	15.0
20.	16.0	17.5	16.5	17.7	17.8	18.1	17.6	14.5	14.7	15.1	15.7	17.4	16.1	15.2	15.1	15.2
30.	16.4	16.6	16.4	18.1	18.0	17.8	16.9	14.4	14.5	14.8	15.6	17.5	16.1	15.0	15.3	15.3
40.	16.5	15.9	17.0	18.3	17.8	17.2	16.2	14.4	14.5	14.6	15.2	17.4	15.9	15.1	15.2	15.3
50.	16.1	15.7	17.6	18.3	17.3	16.8	15.8	14.3	14.4	14.5	15.1	16.9	15.8	15.3	15.4	15.2
60.	15.9	16.6	18.6	18.0	16.9	16.5	15.5	14.2	14.3	14.5	14.7	16.4	15.5	15.4	15.5	15.1
70.	16.5	17.3	19.2	17.5	16.8	16.2	15.4	14.1	14.2	14.3	14.7	15.7	15.5	15.3	15.3	15.1
80.	17.2	17.6	18.7	16.8	16.6	15.5	15.2	14.0	14.0	14.2	14.3	15.2	15.2	15.1	15.1	15.0
90.	16.2	16.7	17.3	16.4	16.3	15.3	15.2	14.0	14.0	14.0	14.1	14.5	14.7	14.5	14.5	14.5
100.	15.4	15.8	16.5	16.4	16.3	15.3	15.2	14.0	14.0	14.0	14.0	14.1	14.1	14.1	14.1	14.1
110.	15.2	15.5	16.6	16.6	16.1	15.4	15.3	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
120.	15.1	15.5	16.8	16.7	16.0	15.6	15.5	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
130.	14.9	15.4	16.8	16.4	15.8	15.7	15.7	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
140.	14.6	15.0	16.6	16.4	16.1	15.9	15.9	14.0	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0
150.	14.3	14.7	16.2	16.3	16.2	16.0	15.7	14.1	14.2	14.2	14.2	14.1	14.0	14.0	14.0	14.0
160.	14.0	14.3	15.3	15.5	15.5	15.4	15.0	14.6	14.7	14.7	14.9	14.9	14.1	14.0	14.0	14.0
170.	14.0	14.0	14.4	14.5	14.5	14.5	14.3	15.2	15.4	15.5	16.2	16.3	14.3	14.1	14.0	14.0
180.	14.0	14.0	14.1	14.2	14.2	14.1	14.1	15.6	15.8	16.0	17.3	17.3	14.8	14.3	14.1	14.0
190.	14.0	14.0	14.0	14.1	14.1	14.1	14.0	15.6	15.6	16.2	17.7	17.5	15.1	14.6	14.3	14.2
200.	14.0	14.0	14.0	14.1	14.1	14.1	14.0	15.5	15.5	16.5	17.6	17.3	15.5	14.7	14.4	14.4
210.	14.0	14.0	14.0	14.1	14.1	14.0	14.0	15.3	15.3	16.7	17.4	17.1	15.7	14.9	14.4	14.4
220.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.2	15.2	16.9	17.2	16.9	15.7	15.1	14.6	14.4
230.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	15.1	16.9	17.0	16.8	15.7	15.3	14.8	14.6
240.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	15.1	16.9	16.9	16.7	15.6	15.3	14.9	14.8
250.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.2	15.2	17.1	17.0	16.5	15.5	15.3	15.0	14.9
260.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	15.2	17.0	16.9	16.3	15.5	15.4	15.0	15.0
270.	14.1	14.1	14.1	14.0	14.0	14.0	14.0	15.1	15.1	17.0	16.9	16.5	15.8	15.5	15.8	16.0
280.	14.3	14.3	14.2	14.1	14.1	14.0	14.0	15.2	15.3	17.3	17.3	16.4	16.6	17.4	17.5	17.2
290.	14.3	14.3	14.3	14.3	14.2	14.1	14.1	15.3	15.7	17.5	17.6	16.7	17.9	18.7	18.2	17.5
300.	14.3	14.3	14.3	14.3	14.2	14.2	14.1	15.5	16.2	17.9	17.9	17.4	19.2	19.0	17.8	16.9

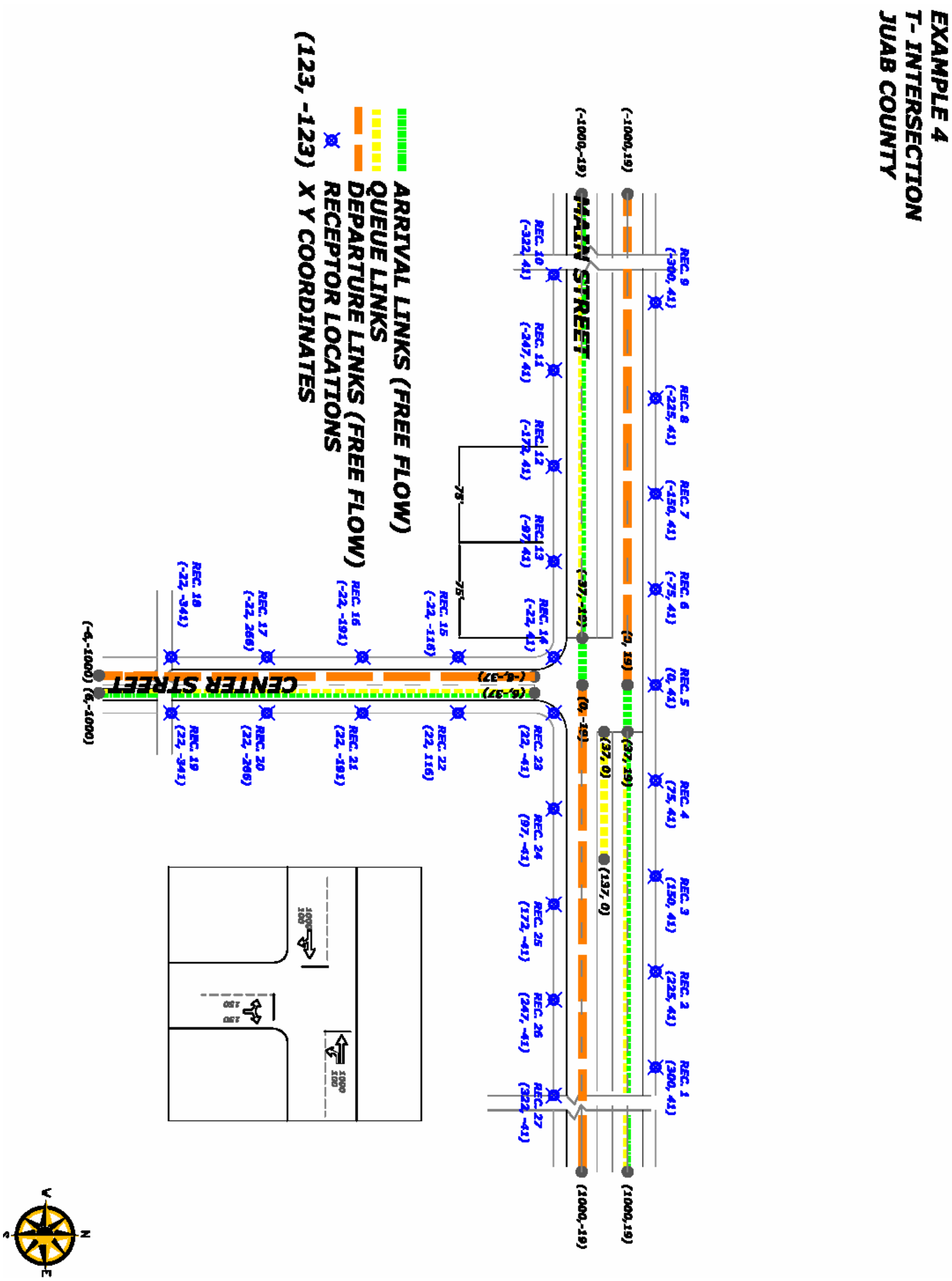
Example 3: CAL3QHC Output (cont.)

```
310.  *  14.2  14.3  14.2  14.3  14.3  14.2  14.1  15.9  17.0  18.3  18.7  18.6  19.8  18.1  17.0  16.2
320.  *  14.3  14.2  14.3  14.3  14.2  14.2  14.1  17.2  18.5  19.3  19.7  19.5  19.2  17.2  16.5  15.8
330.  *  14.2  14.2  14.9  15.0  14.8  14.8  14.7  18.5  19.7  19.9  19.5  19.6  18.4  16.5  16.0  15.5
340.  *  14.2  14.4  16.5  16.7  16.6  16.6  16.2  18.1  18.6  18.6  18.2  18.8  17.7  16.2  15.3  15.4
350.  *  14.4  15.0  18.6  18.4  17.9  18.0  17.9  16.1  16.6  16.4  16.6  18.0  17.0  15.9  15.1  15.1
360.  *  14.8  16.1  19.0  18.2  18.5  18.3  18.4  15.0  15.3  15.5  16.0  17.4  16.5  15.7  15.0  15.0
------*------------------------------------------------------------------------------------------------
MAX   *  17.2  17.6  19.2  18.4  18.5  18.3  18.4  18.5  19.7  19.9  19.7  19.6  19.8  19.0  18.2  17.5
DEGR. *   80    80    70   350     0     0     0   330   330   330   320   330   310   300   290   290

THE HIGHEST CONCENTRATION OF   21.90 PPM OCCURRED AT RECEPTOR REC12.
```

5.4 Example 4: T-Intersection, JUAB COUNTY

This is a hypothetical roadway example that might exist in Juab County. This is 2 lanes in each direction arterial street connected to a local street. The intersection is signalized.



Example 4: T-Intersection

CAL3QHC Input

```
'T-Intersection'  60.     175.       0.   0.     27     0.3048     1   1
'REC 1'          300.      41.       6.
'REC 2'          225.      41.       6.
'REC 3'          150.      41.       6.
'REC 4'           75.      41.       6.
'REC 5'            0.      41.       6.
'REC 6'          -75.      41.       6.
'REC 7'         -150.      41.       6.
'REC 8'         -225.      41.       6.
'REC 9'         -300.      41.       6.
'REC 10'        -322.     -41.       6.
'REC 11'        -247.     -41.       6.
'REC 12'        -172.     -41.       6.
'REC 13'         -97.     -41.       6.
'REC 14'         -22.     -41.       6.
'REC 15'         -22.    -116.       6.
'REC 16'         -22.    -191.       6.
'REC 17'         -22.    -266.       6.
'REC 18'         -22.    -341.       6.
'REC 19'          22.    -341.       6.
'REC 20'          22.    -266.       6.
'REC 21'          22.    -191.       6.
'REC 22'          22.     116.       6.
'REC 23'          22.     -41.       6.
'REC 24'          97.     -41.       6.
'REC 25'         172.     -41.       6.
'REC 26'         247.     -41.       6.
'REC 27'         322.      41.       6.
'T-INTERSECTION'  10        1        0   'C'
1
'MAIN ST WB. APPR.'      'AG'     1000.    19.      0.      19.   1000.  18.0    1.   44.
2
'MAIN ST WB QUEUE'       'AG'       37.    19.   1000.      19.      1.  24.     2
         60 20 2. 1000  197.7     1800      1       3
1
'MAIN ST WB DEP'         'AG'        0.    19.   -1000.     19.   1150.  18.0    1.   44.
2
'MAIN ST WB L. Queue'    'AG'      -37.   -19.   -1000.     19.      1.  12.     1
         60 20 2.  100  197.7     1800 1    3
1
'MAIN ST EB Appr.'       'AG'    -1000.   -19.       0.    -19.   1100.  18.0    1.   44.
2
'MAIN ST EB QUEUE'       'AG'      -37.   -19.   -1000.    -19.      1.  24.     2
         60 20 2. 1100  197.7     1600      1       3
1
'MAIN ST EB DEP.'        'AG'        0.   -19.    1000.    -19.   1150.  16.2    1.   44.
1
'LOCAL T STREET NB APP'  'AG'        6. -1000.       6.      0.    300.  17.1    1.   32.
2
'LOCAL T STREET NB QUEUE.'     'AG'        6.   -37.       6.  -1000.      1.  12.     1
         60 40 2. 200   195.6     1600      1       3
1
 'T STREET SB DEP'       'AG'       -6.   -37.      -6.  -1000.    250.  17.1    1.   32.
1.0 0. 5 1000. 3.  'Y' 10  0 36
```

Example 4: CAL3QHC Output

```
                    CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                       PAGE  1

     JOB: T-Intersection                                        RUN: T-INTERSECTION

     DATE :  7/22/ 3
     TIME : 10: 1:37

        The MODE flag has been set to C for calculating CO averages.

      SITE & METEOROLOGICAL VARIABLES
      -------------------------------
      VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 175. CM
       U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  3.0 PPM

      LINK VARIABLES
      --------------
        LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                             *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT) (FT)       (VEH)
     ------------------------*----------------------------------------*---------------------------------------------------------
      1. MAIN ST WB. APPR.   *   1000.0      19.0        .0      19.0 *    1000.   270. AG   1000.  18.0   1.0 44.0
      2. MAIN ST WB QUEUE    *     37.0      19.0      91.7      19.0 *      55.    90. AG    354. 100.0   1.0 24.0  .46   2.8
      3. MAIN ST WB DEP      *       .0      19.0   -1000.0      19.0 *    1000.   270. AG   1150.  18.0   1.0 44.0
      4. MAIN ST WB L. Queue *    -37.0     -19.0     -47.9     -18.6 *      11.   272. AG    177. 100.0   1.0 12.0  .09    .6
      5. MAIN ST EB Appr.    *  -1000.0     -19.0        .0     -19.0 *    1000.    90. AG   1100.  18.0   1.0 44.0
      6. MAIN ST EB QUEUE    *    -37.0     -19.0     -97.1     -19.0 *      60.   270. AG    354. 100.0   1.0 24.0  .57   3.1
      7. MAIN ST EB DEP.     *       .0     -19.0    1000.0     -19.0 *    1000.    90. AG   1150.  16.2   1.0 44.0
      8. LOCAL T STREET NB AP*      6.0   -1000.0       6.0        .0 *    1000.   360. AG    300.  17.1   1.0 32.0
      9. LOCAL T STREET NB QU*      6.0     -37.0       6.0     -80.7 *      44.   180. AG    350. 100.0   1.0 12.0  .47   2.2
     10. T STREET SB DEP     *     -6.0     -37.0      -6.0   -1000.0 *     963.   180. AG    250.  17.1   1.0 32.0
```

Example 4: CAL3QHC Output (cont.)

JOB: T-Intersection RUN: T-INTERSECTION

DATE : 7/22/ 3
TIME : 10: 1:37

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. MAIN ST WB QUEUE	60	20	2.0	1000	1800	197.70	1	3
4. MAIN ST WB L. Queue	60	20	2.0	100	1800	197.70	1	3
6. MAIN ST EB QUEUE	60	20	2.0	1100	1600	197.70	1	3
9. LOCAL T STREET NB QU	60	40	2.0	200	1600	195.60	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	300.0	41.0	6.0
2. REC 2	225.0	41.0	6.0
3. REC 3	150.0	41.0	6.0
4. REC 4	75.0	41.0	6.0
5. REC 5	.0	41.0	6.0
6. REC 6	-75.0	41.0	6.0
7. REC 7	-150.0	41.0	6.0
8. REC 8	-225.0	41.0	6.0
9. REC 9	-300.0	41.0	6.0
10. REC 10	-322.0	-41.0	6.0
11. REC 11	-247.0	-41.0	6.0
12. REC 12	-172.0	-41.0	6.0
13. REC 13	-97.0	-41.0	6.0
14. REC 14	-22.0	-41.0	6.0
15. REC 15	-22.0	-116.0	6.0
16. REC 16	-22.0	-191.0	6.0
17. REC 17	-22.0	-266.0	6.0
18. REC 18	-22.0	-341.0	6.0
19. REC 19	22.0	-341.0	6.0
20. REC 20	22.0	-266.0	6.0
21. REC 21	22.0	-191.0	6.0
22. REC 22	22.0	116.0	6.0
23. REC 23	22.0	-41.0	6.0
24. REC 24	97.0	-41.0	6.0
25. REC 25	172.0	-41.0	6.0
26. REC 26	247.0	-41.0	6.0
27. REC 27	322.0	41.0	6.0

Example 4: CAL3QHC Output (cont.)

JOB: T-Intersection RUN: T-INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR) * CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.1	4.1	4.1	4.6	4.1	3.8	4.0	3.8	3.7	4.0	4.0
10.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.7	4.0	4.1	4.2	4.0	3.9	3.4	3.5
20.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.1	4.1	4.0	4.9	4.2	4.5	4.2	4.0	3.8	3.3	3.5
30.	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.2	4.2	4.2	5.3	4.4	4.6	4.0	3.8	3.6	3.3	3.4
40.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.2	4.2	4.2	5.4	4.5	4.6	3.8	3.8	3.7	3.3	3.4
50.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.3	4.3	4.3	5.6	4.7	4.4	3.8	3.8	3.8	3.4	3.4
60.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.6	4.5	4.7	6.0	5.0	4.2	3.9	3.8	3.8	3.3	3.4
70.	3.2	3.2	3.2	3.2	3.2	3.2	3.1	3.2	3.2	5.1	5.1	5.4	6.0	5.4	3.9	3.7	3.6	3.4	3.2	3.3
80.	3.6	3.6	3.6	3.6	3.7	3.7	3.7	3.7	3.7	5.4	5.5	5.9	6.0	5.7	3.9	3.5	3.4	3.2	3.0	3.2
90.	4.4	4.4	4.4	4.4	4.8	4.8	4.7	4.8	4.9	4.9	5.1	5.1	5.1	5.2	3.6	3.4	3.3	3.3	3.0	3.0
100.	4.8	4.9	4.9	4.9	5.5	5.4	5.4	5.4	5.3	3.7	3.9	4.0	4.2	4.5	3.2	3.2	3.2	3.2	3.0	3.0
110.	4.7	4.7	4.7	4.8	5.5	5.0	5.3	5.2	5.1	3.2	3.2	3.3	3.6	4.0	3.2	3.2	3.2	3.2	3.0	3.0
120.	4.4	4.4	4.4	4.6	4.9	4.9	5.1	4.8	4.6	3.1	3.1	3.2	3.4	4.0	3.4	3.4	3.4	3.4	3.0	3.0
130.	4.3	4.3	4.3	4.7	4.6	4.6	5.0	4.5	4.4	3.1	3.1	3.2	3.3	4.1	3.4	3.4	3.4	3.4	3.0	3.0
140.	4.1	4.1	4.1	4.6	4.2	4.8	4.7	4.3	4.2	3.1	3.2	3.3	3.3	4.0	3.4	3.4	3.4	3.4	3.0	3.0
150.	4.0	4.0	4.0	4.7	4.0	5.0	4.4	4.2	4.1	3.0	3.1	3.2	3.2	3.7	3.4	3.4	3.4	3.4	3.0	3.0
160.	4.0	4.0	4.0	4.9	4.2	4.9	4.2	4.1	4.0	3.0	3.0	3.2	3.2	3.6	3.5	3.5	3.5	3.5	3.1	3.1
170.	4.0	4.0	4.0	5.0	4.7	4.8	4.2	4.0	4.0	3.0	3.0	3.0	3.2	3.7	3.6	3.6	3.6	3.6	3.2	3.2
180.	4.0	4.0	4.0	5.2	4.9	4.9	4.1	4.1	4.1	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.4	3.5
190.	4.0	4.0	4.1	5.2	4.6	4.5	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.2	3.2	3.6	3.6
200.	4.0	4.1	4.2	5.3	4.3	4.3	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5
210.	4.0	4.1	4.2	5.5	4.5	4.3	4.1	4.1	4.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5
220.	4.1	4.2	4.4	5.7	4.8	4.2	4.2	4.2	4.2	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.4	3.4
230.	4.3	4.4	4.5	5.6	4.9	4.4	4.4	4.4	4.4	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.3	3.3
240.	4.4	4.6	4.9	5.5	5.0	4.6	4.6	4.6	4.6	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.3	3.3
250.	4.9	5.0	5.6	5.6	4.9	4.9	4.9	4.9	4.9	3.2	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0	3.3	3.3
260.	5.2	5.3	5.6	5.5	5.2	5.1	5.1	5.1	5.1	3.6	3.6	3.7	3.7	3.8	3.0	3.0	3.0	3.0	3.3	3.3
270.	4.9	5.0	5.0	4.7	4.7	4.7	4.6	4.6	4.5	4.5	4.5	4.5	4.7	5.0	3.3	3.1	3.0	3.0	3.3	3.3
280.	3.8	3.8	3.8	3.7	3.7	3.7	3.7	3.7	3.7	5.0	5.0	5.1	5.2	5.9	3.7	3.3	3.2	3.0	3.3	3.5
290.	3.1	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	4.8	4.8	4.9	4.9	5.9	3.9	3.6	3.4	3.2	3.5	3.7
300.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.6	4.6	4.6	4.6	5.8	3.8	3.6	3.4	3.4	3.7	3.7
310.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.3	4.3	4.3	4.3	5.4	3.8	3.5	3.4	3.4	3.7	3.7

Example 4: CAL3QHC Output (cont.)

```
320.  *   3.1    3.1    3.1    3.1    3.1    3.1    3.1    3.1    3.1    4.2    4.2    4.2    4.2    5.1    3.8    3.4    3.4    3.4    3.8    3.8
 330.  *   3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    4.2    4.2    4.2    4.2    4.8    4.0    3.5    3.4    3.4    3.9    4.0
 340.  *   3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    4.1    4.1    4.1    4.2    4.4    4.0    3.6    3.5    3.5    3.9    4.0
 350.  *   3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    4.0    4.0    4.0    4.3    4.1    4.0    3.7    3.6    3.4    4.0    4.1
 360.  *   3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    3.0    4.1    4.1    4.1    4.6    4.1    3.8    4.0    3.8    3.7    4.0    4.0
 ------*--------------------------------------------------------------------------------------------------------------------------------------
 MAX   *   5.2    5.3    5.6    5.7    5.5    5.4    5.4    5.4    5.3    5.4    5.5    5.9    6.0    5.9    4.6    4.2    4.0    3.9    4.0    4.1
 DEGR. *  260    260    250    220    100    100    100    100    100     80     80     80     60   280     30     10     10     10      0   350
```

Example 4: CAL3QHC Output (cont.) PAGE 4

JOB: T-Intersection RUN: T-INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	REC21	REC22	REC23	REC24	REC25	REC26	REC27
	CONCENTRATION (PPM)						
0.	4.2	3.0	4.2	4.2	4.0	4.0	3.0
10.	3.8	3.0	4.3	4.1	4.0	4.0	3.0
20.	3.5	3.0	4.4	4.0	4.0	4.0	3.0
30.	3.4	3.0	4.5	4.0	4.0	4.0	3.0
40.	3.4	3.0	4.6	4.1	4.1	4.1	3.1
50.	3.4	3.0	4.7	4.3	4.3	4.3	3.1
60.	3.5	3.0	4.6	4.4	4.4	4.4	3.1
70.	3.5	3.0	4.7	4.7	4.7	4.7	3.2
80.	3.3	3.0	5.0	5.0	5.0	4.9	3.6
90.	3.0	3.3	4.5	4.5	4.5	4.4	4.4
100.	3.0	3.7	3.6	3.6	3.6	3.6	4.8
110.	3.0	3.7	3.2	3.2	3.2	3.2	4.7
120.	3.0	3.7	3.1	3.1	3.1	3.1	4.4
130.	3.0	3.7	3.1	3.1	3.1	3.1	4.3
140.	3.0	3.8	3.1	3.1	3.1	3.1	4.1
150.	3.0	3.9	3.0	3.0	3.0	3.0	4.0
160.	3.1	3.9	3.1	3.0	3.0	3.0	4.0
170.	3.3	4.0	3.3	3.0	3.0	3.0	4.0
180.	3.6	4.0	3.7	3.0	3.0	3.0	4.0
190.	3.6	3.8	3.9	3.2	3.0	3.0	4.0
200.	3.5	3.8	4.2	3.2	3.2	3.0	4.0
210.	3.5	3.8	4.5	3.2	3.2	3.1	4.0
220.	3.4	3.9	4.5	3.3	3.3	3.2	4.1
230.	3.3	3.8	4.3	3.3	3.2	3.1	4.3
240.	3.3	3.7	4.3	3.4	3.2	3.1	4.4
250.	3.3	3.9	4.4	3.6	3.3	3.1	4.8
260.	3.3	3.7	5.0	4.3	3.9	3.8	5.3
270.	3.4	3.3	6.1	5.1	4.8	4.8	4.9
280.	3.6	3.0	6.7	5.5	5.4	5.2	3.7
290.	3.9	3.0	6.0	4.9	5.2	5.0	3.1
300.	3.9	3.0	5.2	4.5	4.7	4.5	3.1
310.	3.8	3.0	4.8	4.5	4.4	4.2	3.1

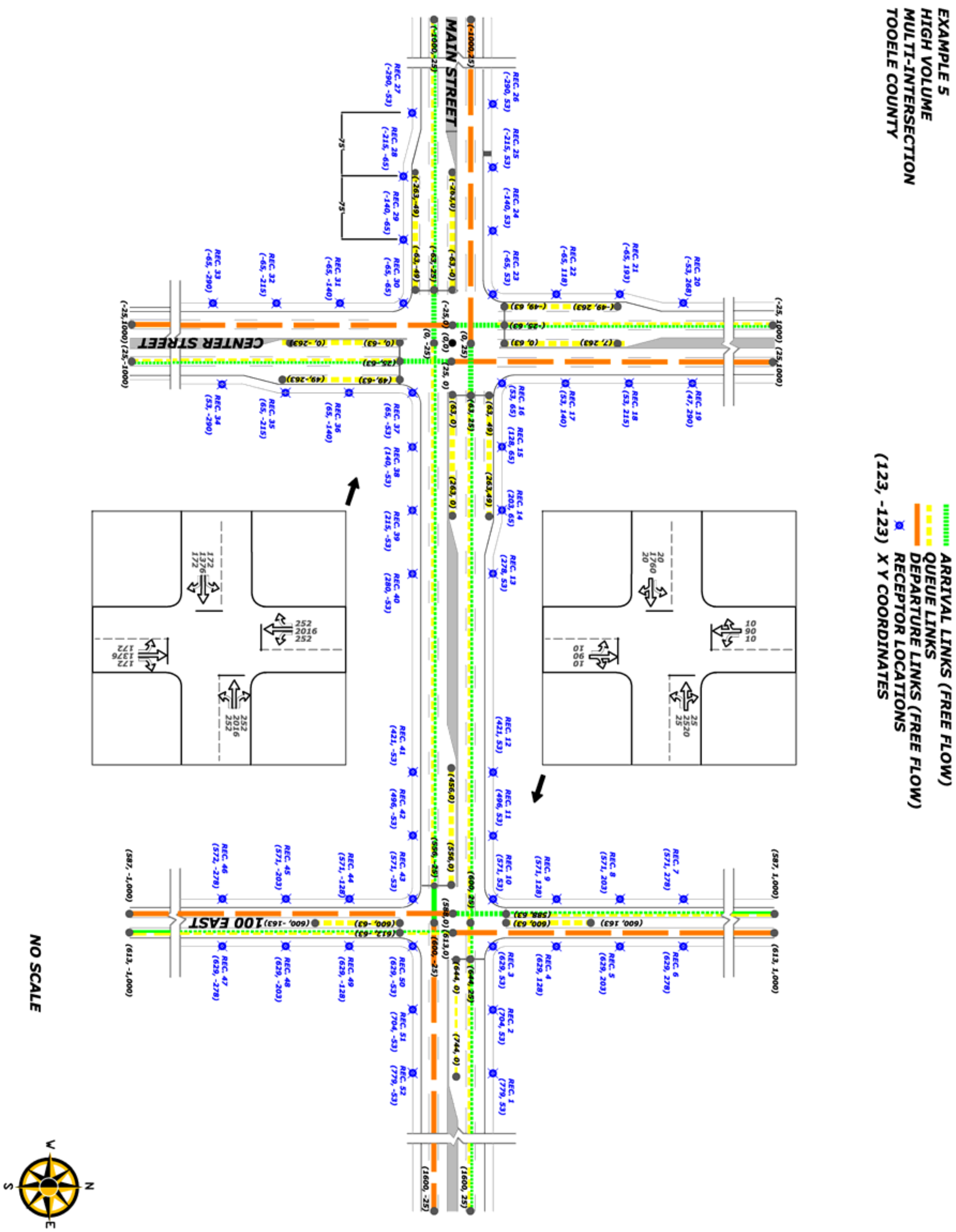
Example 4: CAL3QHC Output (cont.)

```
320.  *   3.9   3.0   4.4   4.6   4.2   4.1   3.1
 330.  *   4.1   3.0   4.3   4.6   4.0   4.0   3.0
 340.  *   4.2   3.0   4.3   4.5   4.0   4.0   3.0
 350.  *   4.1   3.0   4.1   4.4   4.0   4.0   3.0
 360.  *   4.2   3.0   4.2   4.2   4.0   4.0   3.0
 ------*------------------------------------------
 MAX   *   4.2   4.0   6.7   5.5   5.4   5.2   5.3
 DEGR. *    0   170   280   280   280   280   260

 THE HIGHEST CONCENTRATION OF    6.70 PPM OCCURRED AT RECEPTOR REC23.
```

5.5 Example 5: Multiple Intersections

This next example is a somewhat complicated example that shows how CAL3QHC can be used to model multiple intersections along a roadway. The intersection of Main Street and Center Street in this model are major arterials with 12' lanes and a 14' median, 100 East a is one lane in each direction collector street.



Example 5: Multiple Intersections

CAL3QHC Input:

```
'MULTI-4WAY' 60.  108.  0.  0.  52   0.3048 1 1
'REC  1'     779.    53.    6.
'REC  2'     704.    53.    6.
'REC  3'     629.    53.    6.
'REC  4'     629.   128.    6.
'REC  5'     629.   203.    6.
'REC  6'     629.   278.    6.
'REC  7'     571.   278.    6.
'REC  8'     571.   203.    6.
'REC  9'     571.   128.    6.
'REC 10'     571.    53.    6.
'REC 11'     496.    53.    6.
'REC 12'     421.    53.    6.
'REC 13'     278.    53.    6.
'REC 14'     203.    65.    6.
'REC 15'     128.    65.    6.
'REC 16'      53.    65.    6.
'REC 17'      53.   140.    6.
'REC 18'      53.   215.    6.
'REC 19'      53.   290.    6.
'REC 20'     -53.   268.    6.
'REC 21'     -65.   193.    6.
'REC 22'     -65.   118.    6.
'REC 23'     -65.    53.    6.
'REC 24'    -140.    53.    6.
'REC 25'    -215.    53.    6.
'REC 26'    -290.    53.    6.
'REC 27'    -290.   -53.    6.
'REC 28'    -215.   -65.    6.
'REC 29'    -140.   -65.    6.
'REC 30'     -53.   -65.    6.
'REC 31'     -53.  -140.    6.
'REC 32'     -53.  -215.    6.
'REC 33'     -53.  -290.    6.
'REC 34'      53.  -290.    6.
'REC 35'      65.  -215.    6.
'REC 36'      65.  -140.    6.
'REC 37'      53.   -53.    6.
'REC 38'     128.   -53.    6.
'REC 39'     203.   -53.    6.
'REC 40'     278.   -53.    6.
'REC 41'     421.   -53.    6.
'REC 42'     446.   -53.    6.
'REC 43'     571.   -53.    6.
'REC 44'     571.  -128.    6.
'REC 45'     571.  -203.    6.
'REC 46'     571.  -278.    6.
'REC 47'     629.  -278.    6.
'REC 48'     629.  -203.    6.
'REC 49'     629.  -128.    6.
'REC 50'     629.   -53.    6.
```

Example 5: Multiple Intersections
CAL3QHC Input (cont.):

```
'REC 51'     704.   -53.    6.
'REC 52'     779.   -53.    6.'
MULTI INTERSECTION'    34  1  0  'C'
1
'100 E SB APPR'      'AG'       588.    1000.     588.       0.    100.    16.4  1.  12.
2
'100 E SB QUEUE'      'AG'       588.      63.     588.     1000.      1.    12.   1
      60 20 2. 100  195.6  1800 1 3
1
'100 E SB DEP'        'AG'       588.       0.     588.    -1000.    135.    16.4  1.  12.
2
'100 E SB L QUEUE'    'AG'       600.      63.     600.      163.      1.    12.   1
      60 20 2.  10  195.6  1800 1 3
1
'100 E NB APPR'       'AG'       612.   -1000.     612.       0.     100.    16.4  1.  12.
2
'100 E NB QUEUE'      'AG'       612.     -63.     612.   -1000.      1.    12.   1
      60 20 2.  100  195.6  1800 1 3
1
'100 E NB DEP'        'AG'       612.       0.     612.    1000.     90.    16.4  1.  12.
2
'100 E NB L QUEUE'    'AG'       600.     -63.     600.    -156.      1.    12.   1
      60 20 2.   10   195.6  1800 1 3
 1
'MAIN ST WB APPR1'    'AG'      1600.      25.     600.      25.    2545.    18.0   1. 56.
2
'MAIN ST WB QUEUE1'   'AG'       656.      25.     756.      25.       1.    36.    3
      60 20 2. 2545  144.2  1800 1  3
1
'MAIN ST WB APPR2'    'AG'       600.      25.       0.      25.    2540.    18.0   1. 56.
2
'MAIN ST WB QUEUE2'   'AG'        63.      25.     600.      25.       1.    36.    3
      60 20 2. 2540  197.7  1800 1  3
1
'MAIN ST WB DEP.'     'AG'         0.      25.   -1000.      25.    2440.    18.   1. 56.
2
'MAIN ST WB L. QUEUE1'  'AG'      63.       0.     263.       0.       1.    12.    1
      60 28 2. 252  197.7  1800  1  3
2
'MAIN ST WB R. QUEUE1'  'AG'      63.      49.     263.      49.       1.    12.    1
      60 10 2. 252  197.7  1800  1  3
2
'MAIN ST WB L. QUEUE2'  'AG'     644.       0.     744.       0.       1.    12.    1
      60 28 2. 25  197.7  1800  1  3
1
'MAIN ST EB APPR1'    'AG'         0.     -25.   -1000.    -25.    1376.    18.   1. 56.
2
'MAIN ST EB QUEUE1'   'AG'       -63.     -25.   -1000.    -25.       1.    36.    3
      60 20 2. 1376 197.7  1800  1  3
```

Example 5: Multiple Intersections
CAL3QHC Input (cont.):

```
1
'MAIN ST EB APPR2'     'AG'         0.     -25.      600.   -25.     1780.    18.   1. 56.
2
'MAIN ST EB QUEUE2'    'AG'        537.     -25.        0.   -25.        1.    36.    3
       60 20 2. 1780 197.7  1800 1  3
1
'MAIN ST EB DEP.'      'AG'       600.     -25.     1600.   -25.     1780.    18.   1. 56.
2
'MAIN ST EB L QUEUE1'  'AG'        -63.       0.     -263.    0.        1.    12.    1
       60 28 2.  172  197.7  1800 1   3
2
'MAIN ST EB R. QUEUE'  'AG'        -63.     -49.     -263.   -49.       1.    12.    1
       60 10 2. 172      197.7  1800 1 3
2
'MAIN ST EB L QUEUE2'  'AG'        556.       0.      456.     0.       1.    12.    1
       60 28 2. 172  197.7   1800 1   3
1
'CENTER ST.SB APPR.'   'AG'        -25.       0.    -25.  1000.     1376.    18.   1.  56.
2
'CENTER ST. SB QUEUE'  'AG'        -25.      63.    -25.  1000.        1.    36.    3
       60 20 2. 1376     197.7  1800 1 3
1
'CENTER ST.SB DEP.'    'AG'        -25.       0.    -25. -1000.     2440.    18.   1.  56.
2
'CENTER ST.SB LQUEUE'  'AG'          0.      63.      0.   263.        1.    12.    1
       60 28 2.  252     197.7  1800 1 3
2
'CENTER ST. SB RQUEUE' 'AG'        -49.      63.    -49.   263.        1.    12.    1
       60 10 2.  252     197.7  1800 1 3
1
'CENTER ST. NB APPR.'  'AG'         25.       0.     25. -1000.     1376.    18.   1.  56.
2
'CENTER ST. NB QUEUE'  'AG'         25.     -63.     25. -1000.        1.    36.    3
       60 20 2. 1376 197.7  1800 1  3
1
'CENTER ST. NB DEP.'   'AG'         25.       0.     25.  1000.     1800.    18.   1.  56.
2
'CENTER ST. NB L QUEUE' 'AG'         0.     -63.      0.  -263.        1.    12.    1
       60 28 2. 172 197.7  1800 1  3
2
'CENTER ST. NB R QUEUE' 'AG'        49.     -63.     49.  -263.        1.    12.    1
       60 10 2. 172 197.7  1800 1  3
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

Example 5: CAL3QHC Output

CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221   PAGE 1

JOB: MULTI-4WAY   RUN: MULTI INTERSECTION

DATE : 4/29/ 3
TIME : 23:44:41

The MODE flag has been set to C for calculating CO averages.

SITE & METEOROLOGICAL VARIABLES

VS =   .0 CM/S   VD =   .0 CM/S   Z0 = 108. CM
U = 1.0 M/S   CLAS =   5 (E)   ATIM = 60. MINUTES   MIXH = 1000. M   AMB = 3.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1 (FT)	Y1 (FT)	X2 (FT)	Y2 (FT)	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. 100 E SB APPR	588.0	1000.0	588.0	.0	1000.	180.	AG	100.	16.4	1.0	12.0		
2. 100 E SB QUEUE	588.0	63.0	588.0	73.9	11.	360.	AG	175.	100.0	1.0	12.0	.09	.6
3. 100 E SB DEP	588.0	.0	588.0	-1000.0	1000.	180.	AG	135.	16.4	1.0	12.0		
4. 100 E SB L QUEUE	600.0	63.0	600.0	64.1	1.	360.	AG	175.	100.0	1.0	12.0	.01	.1
5. 100 E NB APPR	612.0	-1000.0	612.0	.0	1000.	360.	AG	100.	16.4	1.0	12.0		
6. 100 E NB QUEUE	612.0	-63.0	612.0	-73.9	11.	180.	AG	175.	100.0	1.0	12.0	.09	.6
7. 100 E NB DEP	612.0	.0	612.0	1000.0	1000.	360.	AG	90.	16.4	1.0	12.0		
8. 100 E NB L QUEUE	600.0	-63.0	600.0	-64.1	1.	180.	AG	175.	100.0	1.0	12.0	.01	.1
9. MAIN ST WB APPR1	1600.0	25.0	600.0	25.0	1000.	270.	AG	2545.	18.0	1.0	56.0		
10. MAIN ST WB QUEUE1	656.0	25.0	750.8	25.0	95.	90.	AG	387.	100.0	1.0	36.0	.79	4.8
11. MAIN ST WB APPR2	600.0	25.0	.0	25.0	600.	270.	AG	2540.	18.0	1.0	56.0		
12. MAIN ST WB QUEUE2	63.0	25.0	157.3	25.0	94.	90.	AG	530.	100.0	1.0	36.0	.78	4.8
13. MAIN ST WB DEP.	.0	25.0	-1000.0	25.0	1000.	270.	AG	2440.	18.0	1.0	56.0		
14. MAIN ST WB L. QUEUE1	63.0	.0	101.6	.0	39.	90.	AG	247.	100.0	1.0	12.0	.30	2.0
15. MAIN ST WB R. QUEUE1	63.0	49.0	76.8	49.0	14.	90.	AG	88.	100.0	1.0	12.0	.18	.7
16. MAIN ST WB L. QUEUE2	644.0	.0	647.8	.0	4.	90.	AG	247.	100.0	1.0	12.0	.03	.2
17. MAIN ST EB APPR1	.0	-25.0	-1000.0	-25.0	1000.	270.	AG	1376.	18.0	1.0	56.0		
18. MAIN ST EB QUEUE1	-63.0	-25.0	-113.1	-25.0	50.	270.	AG	530.	100.0	1.0	36.0	.42	2.5
19. MAIN ST EB APPR2	.0	-25.0	600.0	-25.0	600.	90.	AG	1780.	18.0	1.0	56.0		
20. MAIN ST EB QUEUE2	537.0	-25.0	472.1	-25.0	65.	270.	AG	530.	100.0	1.0	36.0	.55	3.3
21. MAIN ST EB DEP.	600.0	-25.0	1600.0	-25.0	1000.	90.	AG	1780.	18.0	1.0	56.0		
22. MAIN ST EB L QUEUE1	-63.0	.0	-89.3	.0	26.	270.	AG	247.	100.0	1.0	12.0	.20	1.3
23. MAIN ST EB R. QUEUE	-63.0	-49.0	-72.4	-49.0	9.	270.	AG	88.	100.0	1.0	12.0	.12	.5
24. MAIN ST EB L QUEUE2	556.0	.0	529.7	.0	26.	270.	AG	247.	100.0	1.0	12.0	.20	1.3
25. CENTER ST.SB APPR.	-25.0	.0	-25.0	1000.0	1000.	360.	AG	1376.	18.0	1.0	56.0		
26. CENTER ST. SB QUEUE	-25.0	63.0	-25.0	113.1	50.	360.	AG	530.	100.0	1.0	36.0	.42	2.5
27. CENTER ST.SB DEP.	-25.0	.0	-25.0	-1000.0	1000.	180.	AG	2440.	18.0	1.0	56.0		
28. CENTER ST.SB LQUEUE	.0	63.0	.0	101.6	39.	360.	AG	247.	100.0	1.0	12.0	.30	2.0
29. CENTER ST. SB RQUEUE	-49.0	63.0	-49.0	76.8	14.	360.	AG	88.	100.0	1.0	12.0	.18	.7
30. CENTER ST. NB APPR.	25.0	.0	25.0	-1000.0	1000.	180.	AG	1376.	18.0	1.0	56.0		
31. CENTER ST. NB QUEUE	25.0	-63.0	25.0	-113.1	50.	180.	AG	530.	100.0	1.0	36.0	.42	2.5

Example 5: CAL3QHC Output (cont.)

```
    32. CENTER ST. NB DEP.  *     25.0        .0       25.0    1000.0 *    1000.    360. AG   1800.  18.0   1.0 56.0
    33. CENTER ST. NB L QUEU*       .0     -63.0         .0     -89.3 *      26.    180. AG    247. 100.0   1.0 12.0  .20   1.3
    34. CENTER ST. NB R QUEU*     49.0     -63.0       49.0     -72.4 *       9.    180. AG     88. 100.0   1.0 12.0  .12    .5
```

Example 5: CAL3QHC Output (cont.)

JOB: MULTI-4WAY RUN: MULTI INTERSECTION

DATE : 4/29/ 3
TIME : 23:44:41

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. 100 E SB QUEUE	60	20	2.0	100	1800	195.60	1	3
4. 100 E SB L QUEUE	60	20	2.0	10	1800	195.60	1	3
6. 100 E NB QUEUE	60	20	2.0	100	1800	195.60	1	3
8. 100 E NB L QUEUE	60	20	2.0	10	1800	195.60	1	3
10. MAIN ST WB QUEUE1	60	20	2.0	2545	1800	144.20	1	3
12. MAIN ST WB QUEUE2	60	20	2.0	2540	1800	197.70	1	3
14. MAIN ST WB L. QUEUE1	60	28	2.0	252	1800	197.70	1	3
15. MAIN ST WB R. QUEUE1	60	10	2.0	252	1800	197.70	1	3
16. MAIN ST WB L. QUEUE2	60	28	2.0	25	1800	197.70	1	3
18. MAIN ST EB QUEUE1	60	20	2.0	1376	1800	197.70	1	3
20. MAIN ST EB QUEUE2	60	20	2.0	1780	1800	197.70	1	3
22. MAIN ST EB L QUEUE1	60	28	2.0	172	1800	197.70	1	3
23. MAIN ST EB R. QUEUE	60	10	2.0	172	1800	197.70	1	3
24. MAIN ST EB L QUEUE2	60	28	2.0	172	1800	197.70	1	3
26. CENTER ST. SB QUEUE	60	20	2.0	1376	1800	197.70	1	3
28. CENTER ST.SB LQUEUE	60	28	2.0	252	1800	197.70	1	3
29. CENTER ST. SB RQUEUE	60	10	2.0	252	1800	197.70	1	3
31. CENTER ST. NB QUEUE	60	20	2.0	1376	1800	197.70	1	3
33. CENTER ST. NB L QUEU	60	28	2.0	172	1800	197.70	1	3
34. CENTER ST. NB R QUEU	60	10	2.0	172	1800	197.70	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	779.0	53.0	6.0
2. REC 2	704.0	53.0	6.0
3. REC 3	629.0	53.0	6.0
4. REC 4	629.0	128.0	6.0
5. REC 5	629.0	203.0	6.0
6. REC 6	629.0	278.0	6.0
7. REC 7	571.0	278.0	6.0
8. REC 8	571.0	203.0	6.0
9. REC 9	571.0	128.0	6.0
10. REC 10	571.0	53.0	6.0
11. REC 11	496.0	53.0	6.0
12. REC 12	421.0	53.0	6.0

Example 5: CAL3QHC Output (cont.)

```
13. REC 13                *       278.0       53.0        6.0   *
 14. REC 14                *       203.0       65.0        6.0   *
 15. REC 15                *       128.0       65.0        6.0   *
 16. REC 16                *        53.0       65.0        6.0   *
 17. REC 17                *        53.0      140.0        6.0   *
 18. REC 18                *        53.0      215.0        6.0   *
 19. REC 19                *        53.0      290.0        6.0   *
 20. REC 20                *       -53.0      268.0        6.0   *
 21. REC 21                *       -65.0      193.0        6.0   *
 22. REC 22                *       -65.0      118.0        6.0   *
 23. REC 23                *       -65.0       53.0        6.0   *
 24. REC 24                *      -140.0       53.0        6.0   *
 25. REC 25                *      -215.0       53.0        6.0   *
```

Example 5: CAL3QHC Output (cont.)

JOB: MULTI-4WAY   RUN: MULTI INTERSECTION

DATE : 4/29/ 3
TIME : 23:44:41

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
26. REC 26	-290.0	53.0	6.0
27. REC 27	-290.0	-53.0	6.0
28. REC 28	-215.0	-65.0	6.0
29. REC 29	-140.0	-65.0	6.0
30. REC 30	-53.0	-65.0	6.0
31. REC 31	-53.0	-140.0	6.0
32. REC 32	-53.0	-215.0	6.0
33. REC 33	-53.0	-290.0	6.0
34. REC 34	53.0	-290.0	6.0
35. REC 35	65.0	-215.0	6.0
36. REC 36	65.0	-140.0	6.0
37. REC 37	53.0	-53.0	6.0
38. REC 38	128.0	-53.0	6.0
39. REC 39	203.0	-53.0	6.0
40. REC 40	278.0	-53.0	6.0
41. REC 41	421.0	-53.0	6.0
42. REC 42	446.0	-53.0	6.0
43. REC 43	571.0	-53.0	6.0
44. REC 44	571.0	-128.0	6.0
45. REC 45	571.0	-203.0	6.0
46. REC 46	571.0	-278.0	6.0
47. REC 47	629.0	-278.0	6.0
48. REC 48	629.0	-203.0	6.0
49. REC 49	629.0	-128.0	6.0
50. REC 50	629.0	-53.0	6.0
51. REC 51	704.0	-53.0	6.0
52. REC 52	779.0	-53.0	6.0

PAGE 4

JOB: MULTI-4WAY RUN: MULTI INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND * CONCENTRATION
ANGLE * (PPM)

(DEGR)*	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0. *	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.4	5.2	5.2	5.1	5.1	4.7
10. *	3.0	3.0	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.8	3.7	3.7	3.7	5.5
20. *	3.0	3.0	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.2	3.0	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.2	5.3
30. *	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1	3.3	3.1	3.1	3.1	3.0	3.0	3.1	3.1	3.1	3.1	4.9
40. *	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1	3.3	3.1	3.1	3.1	3.0	3.0	3.1	3.1	3.1	3.1	4.7
50. *	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.1	3.1	3.1	3.0	3.0	3.1	3.1	3.1	3.1	4.6
60. *	3.2	3.2	3.2	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.2	3.2	3.2	3.0	3.0	3.1	3.1	3.1	3.1	4.5
70. *	3.3	3.3	3.3	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.3	3.4	3.3	3.0	3.0	3.0	3.0	3.0	3.0	4.4
80. *	4.1	4.1	4.3	3.0	3.0	3.0	3.0	3.0	3.0	4.2	4.3	4.3	4.2	3.5	3.6	3.6	3.1	3.0	3.0	4.3
90. *	6.0	6.2	6.5	3.5	3.1	3.0	3.0	3.1	3.5	6.7	6.6	6.5	6.5	5.3	5.3	5.5	3.7	3.3	3.1	4.5
100. *	7.0	7.4	8.1	4.4	3.7	3.3	3.3	3.7	4.4	7.9	7.6	7.5	7.7	6.7	6.6	7.0	4.7	4.0	3.6	5.0
110. *	6.5	7.1	7.7	4.7	4.1	3.8	3.8	4.1	4.8	7.1	6.7	7.0	6.8	6.2	6.1	7.3	4.8	4.4	3.9	5.3
120. *	5.9	6.8	7.0	4.6	4.1	3.8	3.8	4.1	4.9	6.3	6.1	6.4	6.1	5.6	5.6	7.1	4.6	4.3	4.2	5.6
130. *	5.5	6.6	6.3	4.7	4.0	3.8	3.8	4.2	4.8	5.7	5.9	6.3	5.5	5.3	5.7	7.0	4.6	4.1	4.0	5.5
140. *	5.3	6.5	5.8	4.8	4.0	3.8	4.0	4.3	4.7	5.6	5.7	5.8	5.3	5.0	5.7	6.7	4.8	4.1	3.8	5.8
150. *	5.1	6.3	5.4	4.7	4.2	3.9	4.1	4.3	4.4	5.4	5.6	5.5	5.1	4.9	5.9	6.6	4.9	4.2	3.9	6.0
160. *	4.9	6.0	5.1	4.6	4.1	3.9	4.0	4.0	4.4	5.1	5.7	5.0	4.9	4.8	6.0	6.3	5.1	4.4	4.1	6.4
170. *	5.0	6.1	5.0	4.4	4.0	3.9	4.0	4.0	4.3	5.2	5.9	5.0	5.0	4.8	6.1	6.4	5.6	5.1	4.8	7.2
180. *	5.1	6.2	5.2	4.3	4.0	3.8	3.8	4.0	4.6	5.2	5.9	5.1	5.1	5.1	6.6	7.7	7.0	6.7	6.4	6.5
190. *	5.0	6.1	5.2	4.2	4.1	4.0	3.9	4.1	4.4	5.2	5.7	5.0	5.2	5.4	7.3	8.5	7.8	7.5	7.4	4.7
200. *	5.0	6.0	5.2	4.4	4.1	4.0	4.0	4.3	4.8	5.5	5.5	5.1	5.6	5.8	7.7	8.2	7.2	7.3	6.8	3.9
210. *	5.3	6.5	5.5	5.0	4.5	4.3	4.2	4.3	4.9	6.4	5.6	5.6	5.9	6.0	8.0	7.4	6.9	6.6	6.1	3.8
220. *	6.0	6.8	5.9	5.3	4.5	4.3	4.3	4.4	5.0	6.8	5.8	5.8	6.0	6.4	8.2	7.1	7.1	6.1	5.6	3.8
230. *	6.7	7.2	6.4	4.9	4.3	4.1	4.2	4.5	4.9	6.7	6.0	6.0	6.2	7.0	8.0	7.2	6.8	5.6	5.3	3.9
240. *	7.4	7.4	6.8	4.9	4.5	4.3	4.3	4.7	5.0	6.7	6.4	6.5	6.8	7.9	7.7	7.5	6.6	5.4	5.3	3.8
250. *	8.3	7.8	7.2	5.2	4.6	4.3	4.5	4.8	5.1	7.1	7.3	7.2	7.8	8.1	7.6	7.5	6.3	5.4	5.2	3.7
260. *	8.9	8.4	7.9	5.1	4.4	4.0	3.9	4.4	5.3	7.9	8.1	8.2	8.6	7.6	7.2	7.7	5.9	5.0	4.8	3.3
270. *	7.4	6.9	7.0	4.1	3.6	3.4	3.4	3.6	4.2	7.0	7.1	7.2	7.5	6.0	6.0	7.0	4.9	4.6	4.5	3.0
280. *	4.6	4.4	4.5	3.4	3.3	3.3	3.3	3.3	3.4	4.6	4.7	4.8	4.9	4.3	4.8	5.9	4.5	4.5	4.5	3.0
290. *	3.6	3.6	3.6	3.3	3.3	3.3	3.3	3.3	3.3	3.6	3.7	3.7	3.9	3.7	4.1	5.6	4.5	4.5	4.5	3.0
300. *	3.5	3.5	3.5	3.3	3.3	3.3	3.3	3.3	3.3	3.5	3.6	3.6	3.7	3.7	3.9	5.4	4.5	4.5	4.5	3.0
310. *	3.4	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.4	3.5	3.6	3.6	3.7	4.0	5.0	4.6	4.6	4.6	3.1
320. *	3.3	3.3	3.3	3.3	3.2	3.2	3.2	3.3	3.3	3.4	3.5	3.6	3.7	3.7	4.0	5.0	4.9	4.9	4.9	3.1

Example 5: CAL3QHC Output (cont.)

```
330.  *   3.1    3.1    3.2    3.2    3.1    3.1    3.0    3.1    3.1    3.3    3.4    3.5    3.8    3.8    4.1    5.1    5.1    5.1    5.1    3.1
 340.  *   3.0    3.0    3.1    3.1    3.1    3.1    3.0    3.0    3.0    3.0    3.1    3.2    3.5    3.8    4.2    5.6    5.6    5.6    5.5    3.2
 350.  *   3.0    3.0    3.2    3.2    3.1    3.1    3.0    3.0    3.0    3.0    3.0    3.0    3.2    3.4    4.0    6.0    6.0    5.9    5.8    3.5
 360.  *   3.0    3.0    3.1    3.1    3.1    3.1    3.1    3.1    3.1    3.1    3.0    3.0    3.0    3.1    3.4    5.2    5.2    5.1    5.1    4.7
 ------*---------------------------------------------------------------------------------------------------------------------------------------------
 MAX   *   8.9    8.4    8.1    5.3    4.6    4.3    4.5    4.8    5.3    7.9    8.1    8.2    8.6    8.1    8.2    8.5    7.8    7.5    7.4    7.2
 DEGR. *  260    260    100    220    250    210    250    250    260    100    260    260    260    250    220    190    190    190    190    170
```

Example 5: CAL3QHC Output (cont.)

JOB: MULTI-4WAY RUN: MULTI INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	*	4.1	4.1	4.1	3.3	3.0	3.0	4.6	4.6	4.8	7.4	7.0	6.7	6.7	6.3	5.6	5.9	7.4	6.2	5.0	4.9
10.	*	4.9	5.1	5.2	3.9	3.4	3.2	4.7	4.8	5.3	8.0	7.7	7.8	7.7	4.8	4.6	5.0	6.4	5.7	4.9	4.9
20.	*	5.0	5.0	5.5	4.0	3.8	3.4	5.2	5.2	5.7	7.8	7.4	7.7	7.3	4.1	4.0	4.6	6.1	5.3	4.8	4.8
30.	*	4.8	4.8	5.7	4.1	3.9	3.7	5.3	5.3	6.4	7.4	7.1	7.4	6.8	3.8	4.0	4.4	6.2	5.1	4.9	4.9
40.	*	4.5	4.5	5.9	4.1	3.8	3.7	5.4	5.4	7.0	7.0	7.5	6.8	6.2	3.8	3.9	4.2	6.2	5.1	5.0	5.0
50.	*	4.4	4.4	6.1	4.0	3.7	3.6	5.6	5.7	6.9	7.5	7.6	6.2	5.8	4.0	3.9	4.3	6.2	5.3	5.3	5.3
60.	*	4.3	4.3	6.1	4.3	3.9	3.7	5.9	6.4	7.2	7.8	7.0	5.9	5.9	4.0	4.2	4.4	6.0	5.6	5.6	5.7
70.	*	4.3	4.3	5.9	4.7	4.1	3.9	6.5	7.0	7.8	7.9	6.9	6.2	5.9	4.0	4.3	4.7	6.2	6.2	6.3	6.3
80.	*	4.2	4.4	6.3	5.6	5.4	5.1	7.5	7.3	7.6	8.4	6.7	5.7	5.4	3.6	3.9	4.6	7.0	7.1	7.1	7.2
90.	*	4.6	5.7	8.9	8.1	7.5	7.3	6.7	6.2	6.5	7.6	5.4	5.1	5.1	3.1	3.2	3.6	6.1	6.1	6.1	6.0
100.	*	5.4	7.3	9.6	8.7	8.4	8.1	4.7	4.5	4.8	6.2	4.8	4.8	4.8	3.0	3.0	3.0	3.8	3.9	4.0	4.0
110.	*	5.6	7.8	8.3	7.6	7.7	7.3	3.9	3.8	4.2	5.8	4.8	4.8	4.8	3.0	3.0	3.0	3.2	3.2	3.2	3.2
120.	*	5.6	8.0	7.2	7.0	7.0	6.6	3.7	3.8	4.1	5.6	4.9	4.9	4.9	3.0	3.0	3.0	3.1	3.1	3.1	3.1
130.	*	5.9	7.8	6.9	7.2	6.5	6.0	3.7	3.8	4.0	5.4	5.1	5.1	5.1	3.1	3.0	3.0	3.2	3.1	3.1	3.1
140.	*	6.0	7.0	7.1	7.2	6.1	5.8	3.8	3.9	4.2	5.4	5.3	5.3	5.3	3.1	3.0	3.0	3.2	3.1	3.1	3.1
150.	*	6.4	6.8	7.4	6.9	5.8	5.7	3.7	3.9	4.3	5.6	5.6	5.6	5.6	3.1	3.0	3.0	3.2	3.1	3.1	3.1
160.	*	6.7	7.0	7.6	6.7	5.8	5.5	3.6	3.9	4.4	6.2	6.2	6.2	6.2	3.2	3.0	3.0	3.2	3.0	3.0	3.0
170.	*	7.0	7.0	7.8	6.2	5.3	5.1	3.2	3.5	4.1	6.8	6.8	6.7	6.6	3.6	3.2	3.3	3.8	3.0	3.0	3.0
180.	*	5.8	6.2	7.4	5.3	5.0	4.9	3.0	3.1	3.4	5.9	5.8	5.8	5.7	4.9	4.2	4.2	5.4	3.3	3.1	3.0
190.	*	4.4	5.0	6.2	4.8	4.8	4.8	3.0	3.0	3.0	4.1	4.0	4.0	3.9	5.8	5.2	5.3	6.8	4.0	3.4	3.2
200.	*	3.8	4.4	5.8	4.8	4.8	4.8	3.0	3.0	3.0	3.3	3.3	3.3	3.3	5.6	5.3	5.3	6.9	4.4	3.9	3.6
210.	*	3.9	4.2	5.5	4.9	4.9	4.9	3.0	3.0	3.0	3.2	3.2	3.2	3.2	5.2	5.0	5.0	6.8	4.3	4.1	3.9
220.	*	3.9	4.2	5.3	5.1	5.1	5.1	3.1	3.0	3.0	3.1	3.1	3.1	3.1	5.0	4.7	4.7	6.7	4.3	3.9	3.8
230.	*	3.9	4.3	5.4	5.3	5.3	5.3	3.1	3.0	3.0	3.1	3.1	3.1	3.1	4.8	4.6	4.6	6.4	4.3	3.9	3.7
240.	*	4.0	4.4	5.6	5.6	5.6	5.6	3.1	3.0	3.0	3.1	3.1	3.1	3.1	4.7	4.5	4.5	6.1	4.5	4.0	3.7
250.	*	4.0	4.6	6.2	6.2	6.2	6.2	3.2	3.0	3.0	3.0	3.0	3.0	3.0	4.6	4.5	4.5	5.9	4.9	4.1	3.9
260.	*	3.7	4.3	6.8	6.8	6.7	6.6	3.6	3.2	3.3	3.3	3.0	3.0	3.0	4.5	4.4	4.4	5.9	5.5	4.9	4.6
270.	*	3.1	3.5	5.9	5.8	5.8	5.7	4.9	4.2	4.2	4.3	3.3	3.0	3.0	4.6	4.6	4.8	7.3	6.9	6.4	6.3
280.	*	3.0	3.1	4.1	4.0	4.0	3.9	5.8	5.2	5.3	5.5	4.0	3.4	3.2	4.7	4.9	5.4	8.2	7.8	7.7	7.4
290.	*	3.0	3.0	3.3	3.3	3.3	3.3	5.6	5.3	5.3	5.7	4.2	3.9	3.5	5.3	5.3	5.9	7.9	6.9	7.3	7.3
300.	*	3.0	3.0	3.2	3.2	3.2	3.2	5.2	5.0	5.0	5.9	4.3	4.0	3.8	5.4	5.4	6.5	7.2	6.9	7.3	6.8
310.	*	3.0	3.0	3.1	3.1	3.1	3.1	5.0	4.7	4.7	6.0	4.2	3.9	3.8	5.5	5.5	7.0	7.0	7.1	7.0	6.1
320.	*	3.0	3.0	3.1	3.1	3.1	3.1	4.8	4.6	4.6	6.2	4.2	3.9	3.7	5.7	5.8	6.8	6.9	7.2	6.4	5.7

Example 5: CAL3QHC Output (cont.)

```
330.  *   3.0    3.0    3.1    3.1    3.1    3.1    4.7    4.5    4.5    6.2    4.5    4.1    3.8    5.9    6.2    7.0    7.3    7.1    6.1    5.6
 340.  *   3.0    3.0    3.0    3.0    3.0    3.0    4.6    4.5    4.5    6.0    4.7    4.2    4.0    6.4    6.6    7.0    7.6    7.0    5.8    5.4
 350.  *   3.2    3.2    3.2    3.0    3.0    3.0    4.5    4.4    4.4    6.1    5.5    5.0    4.8    7.0    6.5    6.7    8.0    6.8    5.4    5.2
 360.  *   4.1    4.1    4.1    3.3    3.0    3.0    4.6    4.6    4.8    7.4    7.0    6.7    6.7    6.3    5.6    5.9    7.4    6.2    5.0    4.9
 ------*------------------------------------------------------------------------------------------------------------------------------------
 MAX   *   7.0    8.0    9.6    8.7    8.4    8.1    7.5    7.3    7.8    8.4    7.7    7.8    7.7    7.0    6.6    7.0    8.2    7.8    7.7    7.4
 DEGR. *  170    120    100    100    100    100     80     80     70     80     10     10     10    350    340    310    280    280    280    280
```

JOB: MULTI-4WAY RUN: MULTI INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42	REC43	REC44	REC45	REC46	REC47	REC48	REC49	REC50	REC51	REC52
0.	4.9	4.9	4.9	4.2	4.1	3.9	3.8	4.0	4.2	5.0	5.6	4.9
10.	4.9	4.9	5.0	4.3	4.1	3.9	3.9	4.0	4.3	5.0	5.5	4.9
20.	4.8	4.9	5.2	4.3	4.1	4.0	3.9	4.1	4.5	5.3	5.4	4.8
30.	4.9	5.3	5.1	4.6	4.2	3.9	3.8	4.1	4.5	5.4	5.3	4.9
40.	5.1	5.7	5.5	4.7	4.2	3.8	3.7	3.9	4.5	5.6	5.2	5.0
50.	5.8	6.5	5.9	4.7	4.0	4.0	3.9	3.9	4.4	5.9	5.3	5.3
60.	6.6	7.1	6.3	4.7	4.2	4.0	3.9	4.1	4.5	6.1	5.7	5.7
70.	7.6	7.7	6.7	4.7	4.2	3.9	3.7	4.1	4.6	6.2	6.1	6.1
80.	7.8	7.7	6.8	4.4	3.7	3.4	3.2	3.6	4.3	6.6	6.5	6.5
90.	6.2	6.2	5.7	3.6	3.2	3.1	3.0	3.1	3.5	5.5	5.5	5.3
100.	3.9	3.9	4.0	3.1	3.1	3.1	3.0	3.0	3.0	3.8	3.8	3.8
110.	3.2	3.2	3.4	3.1	3.1	3.1	3.0	3.0	3.0	3.2	3.2	3.2
120.	3.1	3.1	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1
130.	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1
140.	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1
150.	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.1	3.1	3.1
160.	3.0	3.0	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0
170.	3.0	3.0	3.2	3.2	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0
180.	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0	3.0
190.	3.0	3.0	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.2	3.0	3.0
200.	3.2	3.2	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.3	3.0	3.0
210.	3.6	3.5	3.3	3.2	3.2	3.0	3.2	3.2	3.3	3.6	3.1	3.1
220.	3.6	3.6	3.5	3.3	3.3	3.3	3.3	3.3	3.4	3.6	3.4	3.3
230.	3.6	3.6	3.6	3.4	3.3	3.3	3.3	3.3	3.3	3.6	3.4	3.4
240.	3.6	3.6	3.6	3.5	3.5	3.5	3.3	3.3	3.3	3.5	3.4	3.4
250.	3.7	3.7	3.7	3.5	3.5	3.5	3.3	3.3	3.3	3.6	3.6	3.5
260.	4.4	4.4	4.4	3.3	3.3	3.3	3.3	3.3	3.3	4.3	4.3	4.4
270.	6.2	6.3	6.8	4.0	3.5	3.4	3.5	3.5	4.2	6.7	6.5	6.3
280.	7.6	7.4	8.2	5.3	4.3	3.8	3.8	4.4	5.0	8.1	7.6	7.3
290.	6.8	6.9	7.8	5.2	4.7	4.2	4.5	4.6	5.2	7.4	6.8	6.8
300.	6.1	6.1	7.2	4.9	4.5	4.4	4.3	4.5	5.0	6.4	6.0	6.3
310.	5.8	5.7	6.5	4.9	4.2	4.1	4.2	4.3	5.1	5.9	5.6	6.3
320.	5.5	5.5	5.9	5.3	4.4	4.1	4.2	4.6	5.0	5.6	5.6	5.8

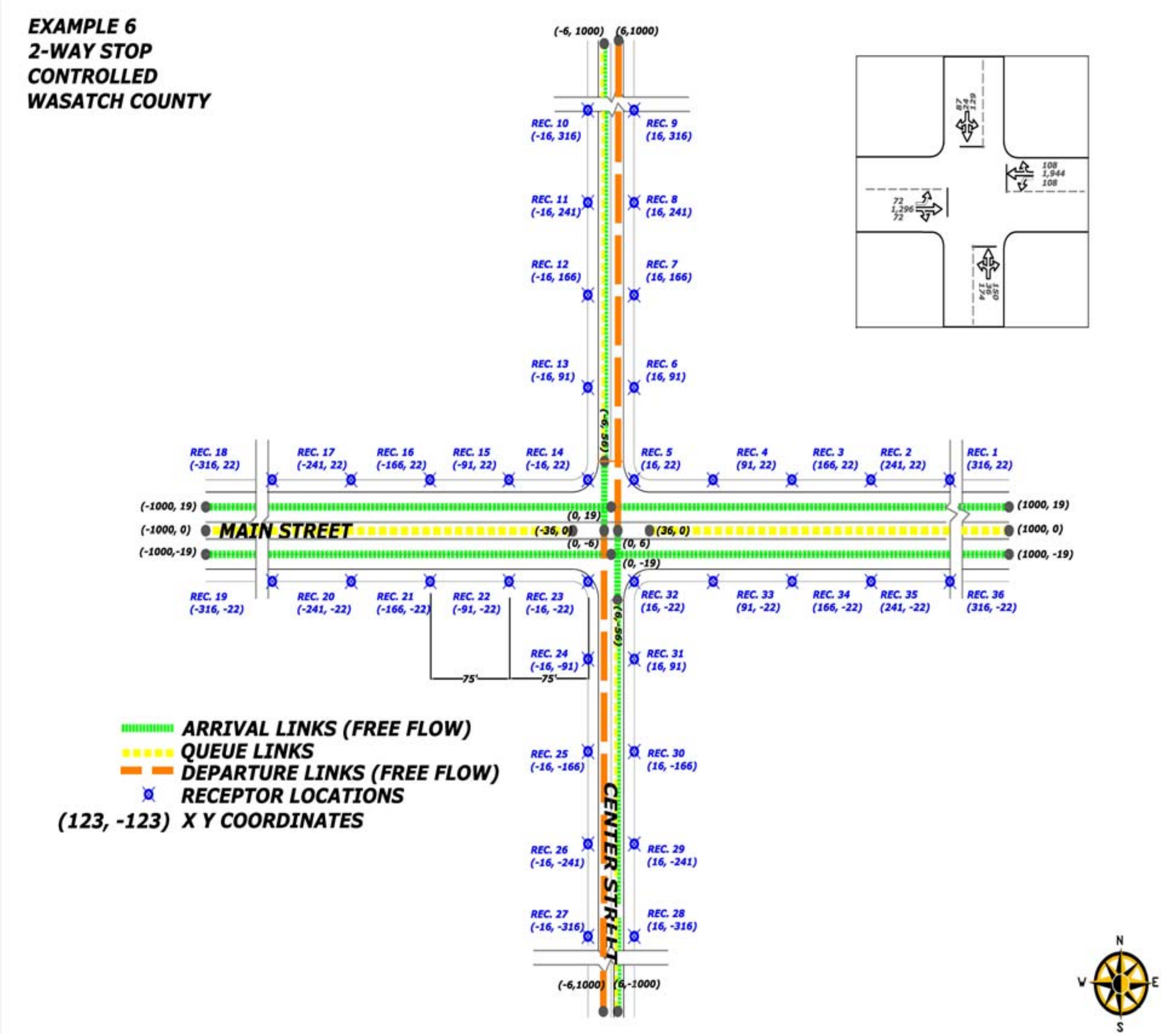
Example 5: CAL3QHC Output (cont.)

```
330.  *   5.4   5.3   5.7   5.0   4.5   4.1   4.4   4.7   4.7   5.3   5.4   5.4
 340.  *   5.1   5.0   5.1   4.7   4.3   4.0   4.2   4.0   4.3   5.1   5.4   5.1
 350.  *   4.9   4.9   5.0   4.4   4.1   3.9   3.9   4.0   4.4   5.1   5.6   5.0
 360.  *   4.9   4.9   4.9   4.2   4.1   3.9   3.8   4.0   4.2   5.0   5.6   4.9
 ------*------------------------------------------------------------------------
 MAX   *   7.8   7.7   8.2   5.3   4.7   4.4   4.5   4.7   5.2   8.1   7.6   7.3
 DEGR. *   80    70    280   320   290   300   290   330   290   280   280   280

 THE HIGHEST CONCENTRATION OF    9.60 PPM OCCURRED AT RECEPTOR REC23.
```

5.6 Example 6: 2-Way Stop Controlled Intersection

This example is a collector street that intersects with a major arterial in Wasatch County. Because there is no traffic signal at the intersection and a stop sign on Center Street, assumed values are coded for signal timing and average red time.



Example 6: 2-Way Stop Controlled Intersection
CAL3QHC Input:

```
'4-WAY STOP CNTRL' 60. 108.  0.  0.  36   0.3048 1 1
'REC 1'        316.     22.    6.
'REC 2'        241.     22.    6.
'REC 3'        166.     22.    6.
'REC 4'         91.     22.    6.
'REC 5'         16.     22.    6.
'REC 6'         16.     91.    6.
'REC 7'         16.    166.    6.
'REC 8'         16.    241.    6.
'REC 9'         16.    316.    6.
'REC 10'       -16     316.    6.
'REC 11'       -16     241.    6.
'REC 12'       -16.    166.    6.
'REC 13'       -16.     91.    6.
'REC 14'       -16.     22.    6.
'REC 15'       -91.     22.    6.
'REC 16'      -166.     22.    6.
'REC 17'      -241.     22.    6.
'REC 18'      -316.     22.    6.
'REC 19'      -316.    -22.    6.
'REC 20'      -241.    -22.    6.
'REC 21'      -166.    -22.    6.
'REC 22'       -91.    -22.    6.
'REC 23'       -16.    -22.    6.
'REC 24'       -16.    -91.    6.
'REC 25'       -16.   -166.    6.
'REC 26'       -16.   -241.    6.
'REC 27'       -16.   -316.    6.
'REC 28'        16.   -316.    6.
'REC 29'        16.   -241.    6.
'REC 30'        16.   -166.    6.
'REC 31'        16.     91.    6.
'REC 32'        16.    -22.    6.
'REC 33'        91.    -22.    6.
'REC 34'       166.    -22.    6.
'REC 35'       241.    -22.    6.
'REC 36'       316.    -22.    6.
'5,000 AADT'    10  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'    1000.     19.       0.     19.  2160.   17.1    1. 44.
1
'ARTERIAL WB DEP.'     'AG'       0.     19.   -1000.     19.  2205.   17.1    1. 44.
```

Example 6
CAL3QHC Input (cont.)

```
1
'ARTERIAL EB APPR.'    'AG'    -1000.    -19.       0.    -19.  1440.   17.1    1. 44.
1
'ARTERIAL EB DEP.'     'AG'        0.    -19.    1000.    -19.  1575.   17.1    1. 44.
1
'LOCAL ST.SB APPR.'    'AG'       -6.   1000.       0.     -6.   240.   18.0    1. 32.
2
'LOCAL ST. SB QUEUE'   'AG'       -6.     56.      -6.   1000.     1.   12.     1
     2 2 2. 240  205.9  1600 1 3
1
'LOCAL ST.SB DEP.'     'AG'       -6.      0.      -6.   -1000.  204.   18.0    1. 32.
1
'LOCAL ST. NB APPR.'   'AG'        6.      0.       6.   -1000.  360.   18.0    1. 32.
2
'LOCAL ST. NB QUEUE'   'AG'        6.    -56.       6.   -1000.    1.   12.     1
     2 2 2. 360  217.9  1600 1 3
1
'LOCAL ST. NB DEP.'    'AG'        6.      0.       6.    1000.  216.   20.0    1. 32.
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

Example 6: CAL3QHC Output

```
CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                         PAGE  1

      JOB: 4-WAY STOP CNTRL                                        RUN: 5,000 AADT

      DATE :  4/30/ 3
      TIME :  0:37:10

         The MODE flag has been set to C for calculating CO averages.

       SITE & METEOROLOGICAL VARIABLES
       -------------------------------
       VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 108. CM
        U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  3.0 PPM

       LINK VARIABLES
       --------------
         LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                              *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT) (FT)        (VEH)
      ------------------------*----------------------------------------*-------------------------------------------------------------
       1. ARTERIAL WB APPR.   *  -1000.0      19.0        .0      19.0 *    1000.    90. AG   2160.  17.1   1.0 44.0
       2. ARTERIAL WB DEP.    *      .0       19.0    1000.0      19.0 *    1000.    90. AG   2205.  17.1   1.0 44.0
       3. ARTERIAL EB APPR.   *   1000.0     -19.0        .0     -19.0 *    1000.   270. AG   1440.  17.1   1.0 44.0
       4. ARTERIAL EB DEP.    *      .0      -19.0   -1000.0     -19.0 *    1000.   270. AG   1575.  17.1   1.0 44.0
       5. LOCAL ST.SB APPR.   *     -6.0    1000.0        .0      -6.0 *    1006.   180. AG    240.  18.0   1.0 32.0
       6. LOCAL ST. SB QUEUE  *     -6.0      56.0      -6.0      58.6 *       3.   360. AG    552. 100.0   1.0 12.0 -.08    .1
       7. LOCAL ST.SB DEP.    *     -6.0        .0      -6.0   -1000.0 *    1000.   180. AG    204.  18.0   1.0 32.0
       8. LOCAL ST. NB APPR.  *      6.0        .0       6.0   -1000.0 *    1000.   180. AG    360.  18.0   1.0 32.0
       9. LOCAL ST. NB QUEUE  *      6.0     -56.0       6.0     -59.9 *       4.   180. AG    584. 100.0   1.0 12.0 -.11    .2
      10. LOCAL ST. NB DEP.   *      6.0        .0       6.0    1000.0 *    1000.   360. AG    216.  20.0   1.0 32.0
```

Example 6: CAL3QHC Output (cont.)

PAGE 2

JOB: 4-WAY STOP CNTRL   RUN: 5,000 AADT

DATE : 4/30/ 3
TIME : 0:37:10

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
6. LOCAL ST. SB QUEUE	2	2	2.0	240	1600	205.90	1	3
9. LOCAL ST. NB QUEUE	2	2	2.0	360	1600	217.90	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	316.0	22.0	6.0
2. REC 2	241.0	22.0	6.0
3. REC 3	166.0	22.0	6.0
4. REC 4	91.0	22.0	6.0
5. REC 5	16.0	22.0	6.0
6. REC 6	16.0	91.0	6.0
7. REC 7	16.0	166.0	6.0
8. REC 8	16.0	241.0	6.0
9. REC 9	16.0	316.0	6.0
10. REC 10	-16.0	316.0	6.0
11. REC 11	-16.0	241.0	6.0
12. REC 12	-16.0	166.0	6.0
13. REC 13	-16.0	91.0	6.0
14. REC 14	-16.0	22.0	6.0
15. REC 15	-91.0	22.0	6.0
16. REC 16	-166.0	22.0	6.0
17. REC 17	-241.0	22.0	6.0
18. REC 18	-316.0	22.0	6.0
19. REC 19	-316.0	-22.0	6.0
20. REC 20	-241.0	-22.0	6.0
21. REC 21	-166.0	-22.0	6.0
22. REC 22	-91.0	-22.0	6.0
23. REC 23	-16.0	-22.0	6.0
24. REC 24	-16.0	-91.0	6.0
25. REC 25	-16.0	-166.0	6.0
26. REC 26	-16.0	-241.0	6.0
27. REC 27	-16.0	-316.0	6.0
28. REC 28	16.0	-316.0	6.0

Example 6: CAL3QHC Output (cont.)

```
    29. REC 29               *       16.0     -241.0        6.0   *
    30. REC 30               *       16.0     -166.0        6.0   *
    31. REC 31               *       16.0       91.0        6.0   *
    32. REC 32               *       16.0      -22.0        6.0   *
    33. REC 33               *       91.0      -22.0        6.0   *
    34. REC 34               *      166.0      -22.0        6.0   *
    35. REC 35               *      241.0      -22.0        6.0   *
    36. REC 36               *      316.0      -22.0        6.0   *
```

Example 6: CAL3QHC Output (cont.)

PAGE 3

JOB: 4-WAY STOP CNTRL RUN: 5,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND * CONCENTRATION
ANGLE * (PPM)

(DEGR)*	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0. *	3.6	3.6	3.6	3.6	4.4	3.7	3.7	3.7	3.7	3.6	3.5	3.5	3.5	4.2	3.6	3.6	3.6	3.6	4.5	4.5
10. *	3.6	3.6	3.6	3.6	4.1	3.4	3.4	3.4	3.4	3.7	3.7	3.7	3.7	4.4	3.8	3.6	3.6	3.6	4.5	4.5
20. *	3.7	3.7	3.7	3.7	3.9	3.1	3.1	3.1	3.1	3.5	3.5	3.5	3.5	4.2	3.8	3.8	3.6	3.6	4.5	4.5
30. *	3.7	3.7	3.7	3.7	3.8	3.1	3.1	3.1	3.1	3.4	3.4	3.4	3.4	4.2	3.9	3.9	3.7	3.7	4.6	4.6
40. *	3.8	3.8	3.8	3.8	3.6	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	4.3	4.0	4.0	3.8	3.8	4.8	4.8
50. *	3.9	3.9	3.9	3.9	3.7	3.0	3.0	3.0	3.0	3.4	3.4	3.4	3.4	4.5	4.1	4.1	3.9	3.9	5.1	5.1
60. *	4.1	4.1	4.1	4.1	4.1	3.0	3.0	3.0	3.0	3.3	3.3	3.3	3.3	4.5	4.2	4.1	4.1	4.1	5.4	5.4
70. *	4.7	4.7	4.7	4.7	4.7	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.2	4.9	4.9	4.6	4.7	4.7	6.0	6.0
80. *	5.8	6.0	6.0	6.0	6.0	3.1	3.0	3.0	3.0	3.2	3.2	3.2	3.3	6.2	6.2	6.1	6.0	6.1	7.1	7.0
90. *	7.1	7.3	7.3	7.3	7.4	3.7	3.1	3.0	3.0	3.2	3.2	3.5	4.1	7.6	7.6	7.5	7.5	7.6	6.9	6.8
100. *	7.0	7.1	7.1	7.2	7.2	4.6	3.7	3.3	3.1	3.3	3.5	3.9	4.8	7.3	7.3	7.2	7.3	7.4	5.3	5.4
110. *	6.0	6.0	6.0	6.0	6.0	4.6	4.1	3.7	3.5	3.7	3.9	4.3	4.8	6.3	6.2	6.3	6.3	6.1	4.2	4.3
120. *	5.4	5.4	5.4	5.4	5.3	4.5	3.9	3.8	3.6	3.9	4.1	4.2	4.8	5.8	5.7	5.6	5.5	5.5	3.8	3.9
130. *	5.0	5.0	5.0	5.0	4.9	4.3	3.9	3.7	3.6	4.0	4.1	4.3	4.7	5.6	5.3	5.1	5.2	5.2	3.7	3.7
140. *	4.7	4.7	4.7	4.7	4.7	4.2	3.8	3.6	3.5	3.9	4.0	4.2	4.5	5.3	4.9	4.8	4.8	4.8	3.7	3.7
150. *	4.6	4.6	4.6	4.6	4.7	4.2	3.9	3.7	3.6	3.9	4.0	4.2	4.7	5.1	4.8	4.8	4.7	4.7	3.6	3.6
160. *	4.5	4.5	4.5	4.5	4.7	4.2	3.9	3.7	3.6	4.0	4.0	4.1	4.7	5.2	4.7	4.7	4.6	4.5	3.5	3.6
170. *	4.5	4.5	4.5	4.5	5.0	4.5	4.0	3.9	3.9	4.0	4.4	4.6	4.8	5.4	4.7	4.6	4.5	4.5	3.5	3.5
180. *	4.4	4.4	4.4	4.5	5.4	4.8	4.5	4.2	4.3	4.2	4.2	4.3	4.9	5.2	4.6	4.5	4.5	4.5	3.5	3.5
190. *	4.5	4.5	4.6	4.7	5.4	4.9	4.6	4.6	4.3	3.6	3.7	4.0	4.4	4.8	4.5	4.5	4.5	4.5	3.5	3.5
200. *	4.5	4.6	4.7	4.8	5.1	4.9	4.3	4.1	4.1	3.6	3.6	3.7	4.1	4.6	4.5	4.5	4.5	4.5	3.5	3.5
210. *	4.7	4.7	4.8	4.8	5.1	4.6	4.2	4.0	3.9	3.5	3.6	3.8	4.1	4.8	4.6	4.6	4.6	4.6	3.5	3.5
220. *	4.8	4.8	4.8	4.9	5.4	4.6	4.2	4.1	3.9	3.5	3.7	3.8	4.1	4.8	4.7	4.7	4.7	4.7	3.6	3.6
230. *	5.1	5.1	5.1	5.2	5.6	4.7	4.2	4.1	4.0	3.6	3.7	3.8	4.3	5.0	5.1	5.1	5.1	5.1	3.6	3.6
240. *	5.5	5.5	5.5	5.7	5.7	4.7	4.3	4.1	3.8	3.6	3.8	4.0	4.4	5.4	5.5	5.5	5.5	5.5	3.8	3.8
250. *	6.1	6.3	6.3	6.2	6.4	4.9	4.2	3.9	3.7	3.5	3.7	4.0	4.7	6.1	6.1	6.1	6.1	6.1	4.2	4.2
260. *	7.3	7.3	7.3	7.2	7.4	4.8	3.9	3.5	3.3	3.1	3.3	3.7	4.6	7.2	7.2	7.2	7.2	7.0	5.2	5.2
270. *	7.6	7.6	7.6	7.7	7.7	4.0	3.5	3.2	3.2	3.0	3.0	3.2	3.7	7.4	7.4	7.2	7.2	7.1	6.4	6.5
280. *	6.1	6.2	6.0	6.2	6.1	3.3	3.2	3.2	3.2	3.0	3.0	3.0	3.1	6.0	5.9	5.9	5.9	5.9	6.7	6.8
290. *	4.7	4.7	4.7	5.0	4.9	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0	4.7	4.7	4.7	4.7	4.7	6.0	6.0
300. *	4.1	4.1	4.1	4.3	4.6	3.3	3.3	3.3	3.3	3.0	3.0	3.0	3.0	4.0	4.1	4.1	4.1	4.1	5.4	5.4
310. *	3.9	3.9	4.1	4.1	4.5	3.4	3.4	3.4	3.4	3.0	3.0	3.0	3.0	3.7	3.9	3.9	3.9	3.9	5.1	5.1
320. *	3.8	3.8	4.0	4.0	4.4	3.4	3.4	3.4	3.4	3.0	3.0	3.0	3.0	3.6	3.8	3.8	3.8	3.8	4.8	4.8

Example 6: CAL3QHC Output (cont.)

330.	*	3.7	3.7	3.9	3.9	4.2	3.4	3.4	3.4	3.4	3.0	3.0	3.0	3.0	3.6	3.7	3.7	3.7	3.7	4.6	4.6
340.	*	3.7	3.7	3.9	3.9	4.3	3.6	3.6	3.6	3.6	3.1	3.1	3.0	3.0	3.7	3.6	3.6	3.6	3.6	4.5	4.5
350.	*	3.6	3.6	3.6	3.8	4.4	3.8	3.8	3.7	3.7	3.3	3.3	3.3	3.3	3.9	3.6	3.6	3.6	3.6	4.5	4.5
360.	*	3.6	3.6	3.6	3.6	4.4	3.7	3.7	3.7	3.7	3.6	3.5	3.5	3.5	4.2	3.6	3.6	3.6	3.6	4.5	4.5
MAX	*	7.6	7.6	7.6	7.7	7.7	4.9	4.6	4.6	4.3	4.2	4.4	4.6	4.9	7.6	7.6	7.5	7.5	7.6	7.1	7.0
DEGR.	*	270	270	270	270	270	190	190	190	180	180	170	170	180	90	90	90	90	90	80	80

Example 6: CAL3QHC Output (cont.)

```
PAGE  4
      JOB: 4-WAY STOP CNTRL                                        RUN: 5,000 AADT

       MODEL RESULTS
       -------------

       REMARKS : In search of the angle corresponding to
                 the maximum concentration, only the first
                 angle, of the angles with same maximum
                 concentrations, is indicated as maximum.

 WIND ANGLE RANGE:   0.-360.
```

WIND ANGLE (DEGR)	* CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36
0.	4.5	4.5	5.1	4.7	4.4	4.3	4.2	4.3	4.4	4.5	3.7	5.3	4.6	4.6	4.6	4.6
10.	4.5	4.7	5.3	4.8	4.5	4.4	4.5	3.8	3.8	4.2	3.4	4.9	4.5	4.5	4.5	4.5
20.	4.7	4.7	5.2	4.9	4.2	4.0	4.1	3.7	3.7	3.9	3.1	4.7	4.6	4.6	4.6	4.6
30.	4.8	4.8	5.2	4.7	4.2	4.0	4.0	3.6	3.7	3.8	3.1	4.9	4.6	4.6	4.6	4.6
40.	5.0	5.0	5.3	4.8	4.2	4.2	4.0	3.6	3.8	3.8	3.0	4.7	4.7	4.7	4.7	4.7
50.	5.3	5.3	5.7	4.7	4.2	4.0	3.8	3.5	3.7	3.9	3.0	4.9	5.0	5.0	5.0	5.0
60.	5.4	5.5	5.7	4.6	4.2	4.0	3.9	3.5	3.7	3.9	3.0	5.3	5.4	5.4	5.4	5.4
70.	6.1	6.0	6.3	4.8	4.2	4.0	3.8	3.4	3.7	3.9	3.0	5.9	5.9	5.9	5.9	5.9
80.	6.9	7.1	7.0	4.7	3.9	3.7	3.5	3.2	3.3	3.6	3.1	6.7	6.7	6.7	6.6	6.6
90.	6.8	6.9	6.8	4.0	3.5	3.3	3.3	3.0	3.0	3.2	3.7	6.5	6.5	6.4	6.3	6.2
100.	5.4	5.5	5.5	3.4	3.3	3.3	3.3	3.0	3.0	3.0	4.6	5.1	5.1	5.1	5.0	5.0
110.	4.3	4.4	4.5	3.3	3.3	3.3	3.3	3.0	3.0	3.0	4.6	4.1	4.1	4.1	4.1	4.1
120.	3.9	4.0	4.1	3.3	3.3	3.3	3.3	3.0	3.0	3.0	4.5	3.7	3.7	3.7	3.7	3.7
130.	3.7	3.8	4.1	3.3	3.3	3.3	3.3	3.0	3.0	3.0	4.3	3.5	3.6	3.6	3.6	3.6
140.	3.7	3.8	4.2	3.5	3.5	3.5	3.5	3.1	3.1	3.1	4.2	3.5	3.5	3.5	3.5	3.5
150.	3.7	3.7	4.2	3.5	3.5	3.5	3.5	3.1	3.1	3.1	4.2	3.5	3.5	3.5	3.5	3.5
160.	3.7	3.7	4.2	3.7	3.7	3.7	3.7	3.2	3.2	3.2	4.2	3.7	3.4	3.4	3.4	3.4
170.	3.6	3.7	4.1	3.7	3.7	3.7	3.7	3.5	3.5	3.5	4.5	4.0	3.4	3.4	3.4	3.4
180.	3.5	3.6	4.2	3.7	3.7	3.7	3.6	3.8	3.8	3.8	4.8	4.3	3.5	3.4	3.4	3.4
190.	3.5	3.5	3.8	3.3	3.3	3.3	3.3	3.8	3.8	3.8	4.9	4.4	3.6	3.5	3.4	3.4
200.	3.5	3.5	3.6	3.1	3.1	3.1	3.1	3.6	3.6	3.6	4.9	4.3	3.7	3.6	3.5	3.4
210.	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.6	3.6	3.6	4.6	4.1	3.7	3.7	3.6	3.6
220.	3.6	3.6	3.4	3.0	3.0	3.0	3.0	3.4	3.4	3.4	4.6	4.0	3.7	3.6	3.6	3.6
230.	3.6	3.6	3.5	3.0	3.0	3.0	3.0	3.3	3.3	3.3	4.7	4.0	3.8	3.7	3.7	3.7
240.	3.8	3.8	3.8	3.0	3.0	3.0	3.0	3.3	3.3	3.3	4.7	4.1	3.9	3.8	3.8	3.8
250.	4.2	4.2	4.2	3.0	3.0	3.0	3.0	3.3	3.3	3.3	4.9	4.5	4.5	4.2	4.3	4.1
260.	5.2	5.3	5.3	3.1	3.0	3.0	3.0	3.3	3.3	3.3	4.8	5.5	5.4	5.2	5.3	5.2
270.	6.6	6.7	6.7	3.7	3.2	3.0	3.0	3.3	3.3	3.5	4.0	7.0	6.9	6.8	6.8	6.7
280.	6.8	6.9	6.9	4.5	3.6	3.3	3.2	3.5	3.7	4.0	3.3	7.2	6.9	6.8	6.9	6.9
290.	6.0	6.0	5.9	4.6	4.0	3.7	3.4	3.7	4.0	4.3	3.2	6.3	5.9	5.9	5.9	5.8
300.	5.4	5.4	5.3	4.4	3.9	3.7	3.6	3.9	4.0	4.2	3.3	5.8	5.6	5.4	5.3	5.3
310.	5.1	5.1	5.0	4.3	3.9	3.7	3.6	3.9	4.0	4.2	3.4	5.6	5.2	5.2	5.0	5.0
320.	4.8	4.8	4.8	4.1	3.8	3.7	3.5	3.9	4.1	4.2	3.4	5.4	4.9	4.9	4.7	4.7

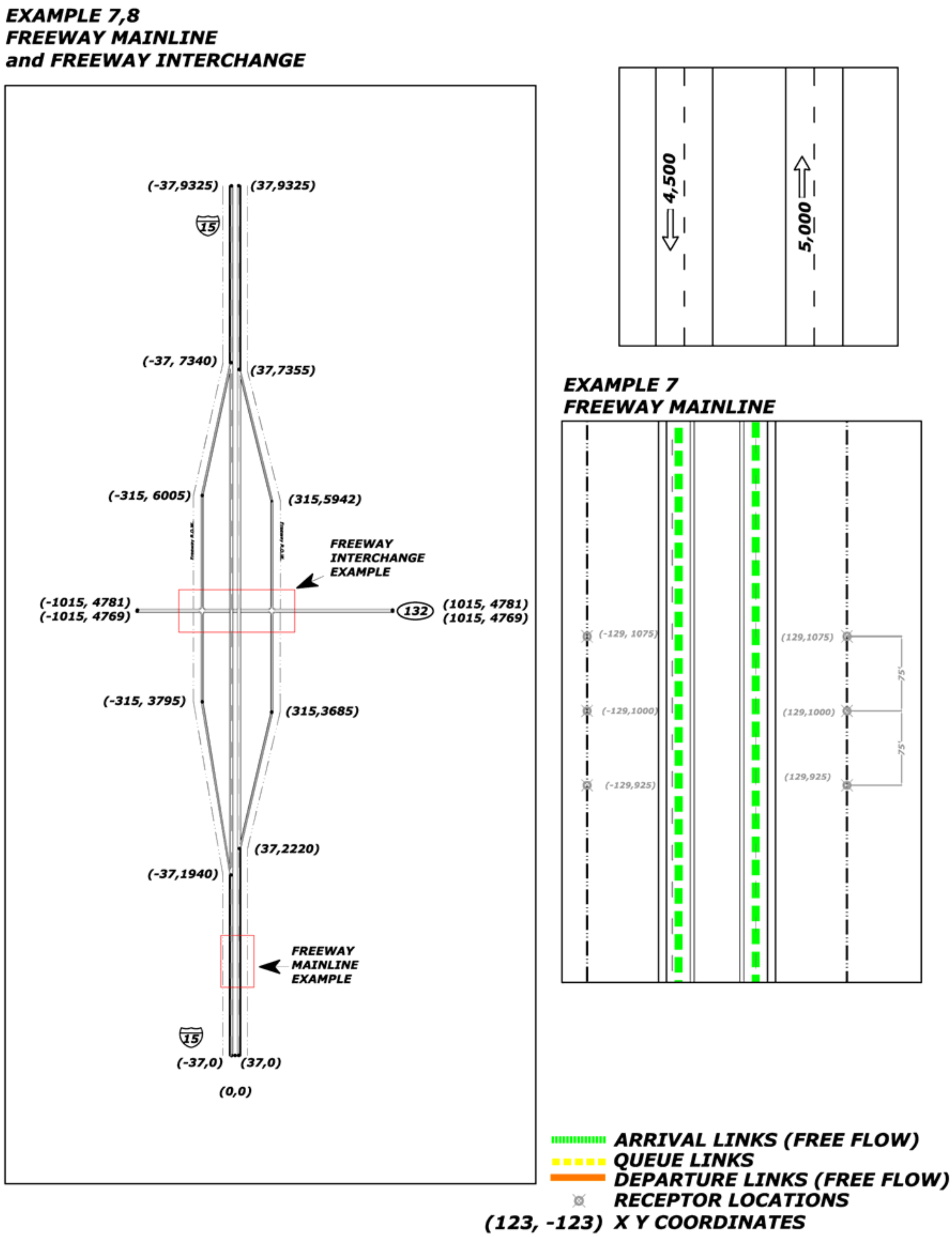
Example 6: CAL3QHC Output (cont.)

```
330.  *   4.6   4.6   4.7   4.1   3.8   3.6   3.5   4.1   4.2   4.3   3.4   5.2   4.8   4.8   4.6   4.6
340.  *   4.5   4.5   4.8   4.1   3.8   3.7   3.6   4.1   4.1   4.3   3.6   5.1   4.7   4.8   4.6   4.6
350.  *   4.5   4.5   4.8   4.3   4.0   3.8   3.8   4.4   4.5   4.6   3.8   5.3   4.7   4.5   4.5   4.5
360.  *   4.5   4.5   5.1   4.7   4.4   4.3   4.2   4.3   4.4   4.5   3.7   5.3   4.6   4.6   4.6   4.6
------*-------------------------------------------------------------------------------------------------
MAX   *   6.9   7.1   7.0   4.9   4.5   4.4   4.5   4.4   4.5   4.6   4.9   7.2   6.9   6.8   6.9   6.9
DEGR. *   80    80    80    20    10    10    10   350   350   350   190   280   270   270   280   280

THE HIGHEST CONCENTRATION OF    7.70 PPM OCCURRED AT RECEPTOR REC4
```

5.7 Example 7: Mainline Freeway

The following example shows how CAL3QHC can be used to model free flow links such as those on freeways. The example is a freeway with a 40 foot median and a 50 foot right of way on either side of the freeway. Example 8 is an example of the interchange.



Example 7: Mainline Freeway
CAL3QHC Input:

```
'FREEWAY' 60. 10.  0.  0.  6   0.3048 1 1
'REC 1'          129.    1075.     6.
'REC 2'          129.    1000.     6.
'REC 3'          129.     925.     6.
'REC 4'         -129.    1075.     6.
'REC 5'         -129.    1000.     6.
'REC 6'         -129.     925.     6.
'MAINLINE'    2  1  0  'C'
1
'FREEWAY NB.'     'AG'    37.   0.      37.     2220.  5000.   22.6    1. 44.
1
'FREEWAY SB.'    'AG'   -37.   0.     -37.     1940.  4500.   22.6    1. 44.
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

Example 7: CAL3QHC Output

```
                  CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

JOB: FREEWAY                                                RUN: MAINLINE

DATE :  4/30/ 3
TIME :  9: 5:24

   The MODE flag has been set to C for calculating CO averages.

 SITE & METEOROLOGICAL VARIABLES
 -------------------------------
 VS =    .0 CM/S       VD =    .0 CM/S       Z0 =  10. CM
  U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  3.0 PPM

 LINK VARIABLES
 --------------
   LINK DESCRIPTION     *         LINK COORDINATES (FT)           *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                        *   X1        Y1        X2        Y2      *     (FT)  (DEG)             (G/MI)  (FT)  (FT)       (VEH)
------------------------*-----------------------------------------*-----------------------------------------------------------
 1. FREEWAY NB.         *     37.0        .0      37.0    2220.0 *    2220.   360. AG   5000.  22.6   1.0 44.0
 2. ARTERIAL EB.        *    -37.0        .0     -37.0    1940.0 *    1940.   360. AG   4500.  22.6   1.0 44.0
```

Example 7: CAL3QHC Output (cont.)

```
                                                                                                                              PAGE  2
      JOB: FREEWAY                                          RUN: MAINLINE

      DATE :  4/30/ 3
      TIME :  9: 5:24

       ADDITIONAL QUEUE LINK PARAMETERS
       --------------------------------
         LINK DESCRIPTION     *    CYCLE    RED     CLEARANCE  APPROACH  SATURATION   IDLE   SIGNAL   ARRIVAL
                              *    LENGTH   TIME    LOST TIME    VOL     FLOW RATE   EM FAC   TYPE     RATE
                              *     (SEC)   (SEC)     (SEC)     (VPH)      (VPH)    (gm/hr)
      ------------------------*--------------------------------------------------------------------------------

       RECEPTOR LOCATIONS
       ------------------
                              *           COORDINATES (FT)          *
         RECEPTOR             *      X           Y          Z       *
     -------------------------*-------------------------------------*
      1. REC 1                *       129.0     1075.0        6.0   *
      2. REC 2                *       129.0     1000.0        6.0   *
      3. REC 3                *       129.0      925.0        6.0   *
      4. REC 4                *      -129.0     1075.0        6.0   *
      5. REC 5                *      -129.0     1000.0        6.0   *
      6. REC 6                *      -129.0      925.0        6.0   *
```

Example 7: CAL3QHC Output (cont.)


```
JOB: FREEWAY                                                RUN: MAINLINE

 MODEL RESULTS
 -------------

 REMARKS : In search of the angle corresponding to
           the maximum concentration, only the first
           angle, of the angles with same maximum
           concentrations, is indicated as maximum.

WIND ANGLE RANGE:   0.-360.

WIND  * CONCENTRATION
ANGLE *      (PPM)
(DEGR)* REC1  REC2  REC3  REC4  REC5  REC6
------*------------------------------------
  0.  *   4.2   4.3   4.5   3.9   4.1   4.2
 10.  *   3.0   3.0   3.0   7.2   7.4   7.6
 20.  *   3.0   3.0   3.0   7.8   7.8   7.8
 30.  *   3.0   3.0   3.0   7.1   7.1   7.1
 40.  *   3.0   3.0   3.0   6.8   6.8   6.8
 50.  *   3.0   3.0   3.0   6.4   6.4   6.4
 60.  *   3.0   3.0   3.0   6.2   6.2   6.2
 70.  *   3.0   3.0   3.0   6.1   6.1   6.1
 80.  *   3.0   3.0   3.0   6.1   6.1   6.1
 90.  *   3.0   3.0   3.0   6.1   6.1   6.1
100.  *   3.0   3.0   3.0   6.1   6.1   6.1
110.  *   3.0   3.0   3.0   6.1   6.1   6.1
120.  *   3.0   3.0   3.0   6.2   6.2   6.2
130.  *   3.0   3.0   3.0   6.4   6.4   6.4
140.  *   3.0   3.0   3.0   6.8   6.8   6.8
150.  *   3.0   3.0   3.0   7.1   7.1   7.1
160.  *   3.0   3.0   3.0   7.8   7.7   7.7
170.  *   3.0   3.0   3.0   7.3   7.2   6.9
180.  *   4.2   4.2   4.0   4.1   4.1   3.9
190.  *   7.6   7.4   7.1   3.0   3.0   3.0
200.  *   7.9   7.8   7.8   3.0   3.0   3.0
210.  *   7.2   7.2   7.2   3.0   3.0   3.0
220.  *   6.8   6.8   6.8   3.0   3.0   3.0
230.  *   6.4   6.4   6.4   3.0   3.0   3.0
240.  *   6.3   6.3   6.3   3.0   3.0   3.0
250.  *   6.2   6.2   6.2   3.0   3.0   3.0
260.  *   6.1   6.1   6.1   3.0   3.0   3.0
270.  *   6.1   6.1   6.1   3.0   3.0   3.0
280.  *   6.1   6.1   6.1   3.0   3.0   3.0
290.  *   6.2   6.2   6.2   3.0   3.0   3.0
300.  *   6.3   6.3   6.3   3.0   3.0   3.0
310.  *   6.4   6.4   6.4   3.0   3.0   3.0
320.  *   6.8   6.8   6.8   3.0   3.0   3.0
```

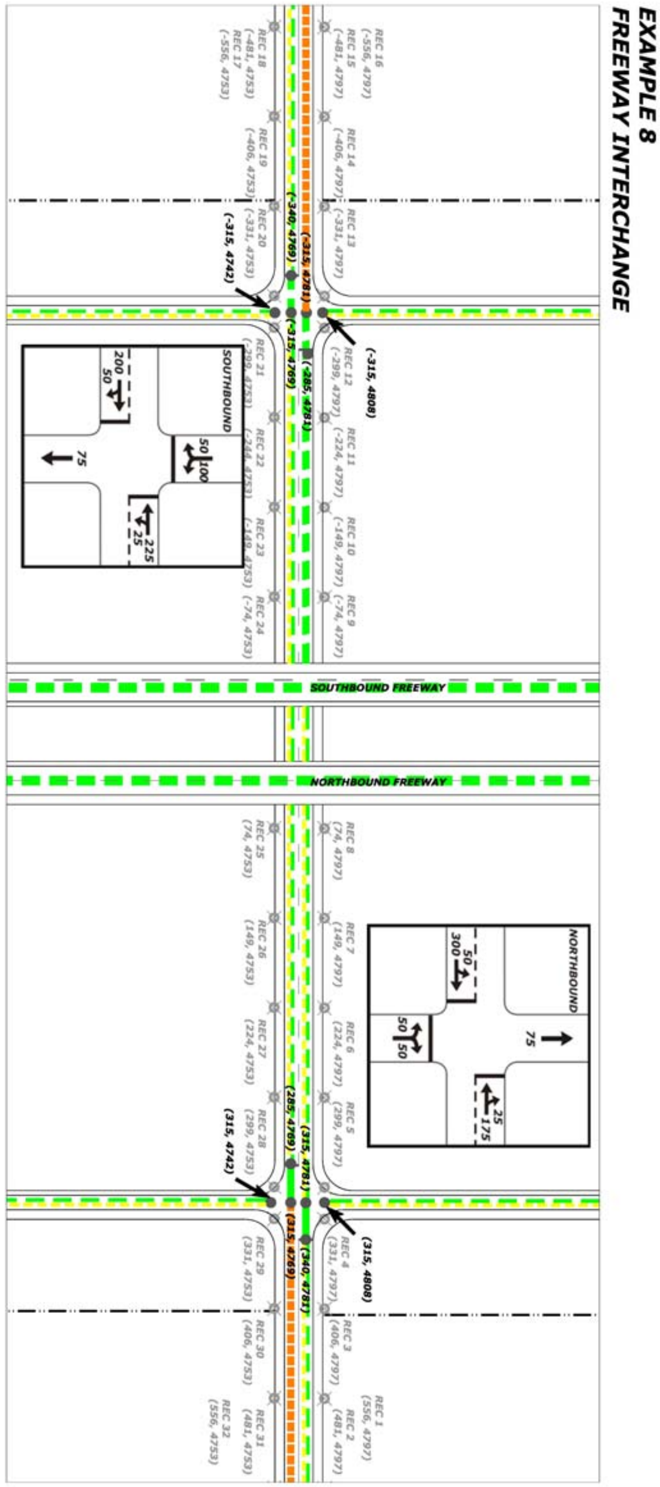
Example 7: CAL3QHC Output (cont.)

```
330.  *   7.2   7.2   7.2   3.0   3.0   3.0
340.  *   7.8   7.8   7.8   3.0   3.0   3.0
350.  *   7.2   7.5   7.7   3.0   3.0   3.0
360.  *   4.2   4.3   4.5   3.9   4.1   4.2
------*------------------------------------
MAX   *   7.9   7.8   7.8   7.8   7.8   7.8
DEGR. *  200   200   200    20    20    20

THE HIGHEST CONCENTRATION OF    7.90 PPM OCCURRED AT RECEPTOR REC1 .
```

5.8 Example 8: Freeway Interchange

This example is similar to the multiple intersection example. However, freeway links have been added to the model as a “bridged link” with the source height of the bridged link at 21 feet. The traffic volumes from the main line example (Example 7) are included in this example.



Example 8: Freeway Interchange

CAL3QHC Input:

```
'FREEWAY' 60. 10.  0.  0.  32  0.3048 1 1
'REC 1'          556.    4797      6.
'REC 2'          481.    4797.     6.
'REC 3'          406.    4797.     6.
'REC 4'          331.    4797.     6.
'REC 5'          299.    4797.     6.
'REC 6'          224.    4797.     6.
'REC 7'          149.    4797.     6.
'REC 8'           74.    4797.     6.
'REC 9'          -74.    4797.     6.
'REC 10'        -149.    4797.     6.
'REC 11'        -224.    4797.     6.
'REC 12'        -299.    4797.     6.
'REC 13'        -331.    4797.     6.
'REC 14'        -406.    4797.     6.
'REC 15'        -481.    4797.     6.
'REC 16'        -556.    4797.     6.
'REC 17'        -556.    4753.     6.
'REC 18'        -481.    4753.     6.
'REC 19         -406.    4753.     6.
'REC 20'        -331.    4753.     6.
'REC 21'        -299.    4753.     6.
'REC 22'        -244.    4753.     6.
'REC 23'        -149.    4753.     6.
'REC 24'         -74.    4753.     6.
'REC 25'          74.    4753.     6.
'REC 26.         149.    4753.     6.
'REC 27'         224.    4753.     6.
'REC 28'         299.    4753.     6.
'REC 29.         331.    4753.     6.
'REC 30'         406.    4753.     6.
'REC 31'         481.    4753.     6.
'REC 32'         556.    4753.     6.
'INTERCHANGE'     26  1  0  'C'
1
'I-15 NB1'        'AG'    37.      0.     37.     2220.  4000.   22.6    1. 44.
1
'I-15 NB2'        'BR'    37.   2220.     37.     7355.  3900.   22.6   21. 44.
1
'I-15 NB3'        'AG'    37.   7355.     37.     9325.  3975.   22.6    1. 44.
1
'NB OFFRAMP1'      'AG'    37.   2220.    315.     3685.   100.   17.5    1. 32.
1
'NB OFFRAMP2'      'AG'   315.   3685.    315.     4742.   100.   15.8    1. 32.
2
'NB EXIT QUEUE'    'AG'   315.   4742.    315.     3685.     1.   12.     1
       40 20 2. 100  193.1  1800 1 3
1
'NB ONRAMP1'       'AG'    315.  4781.   315.     5942.    75.   17.5    1. 32.
1
'NB ONRAMP2'       'AG'    315.  5942.    37.     7355.    75.   22.6    1. 32.
 1
```

Example 8: Freeway Interchange
CAL3QHC Input (cont.)

```
'I-15 SB1'        'AG'    -37.  9325.   -37.     7340.  5000.   22.6    1. 44.
 1
'I-15 SB2'        'BR'    -37.  7340.   -37.     1940.  4850.   22.6   21. 44.
 1
'I-15 SB2'        'AG'    -37.  1940.   -37.        0.  4925.   22.6    1. 44.
 1
'SB OFFRAMP1'      'AG'     -37.  7340.   -315.    6005.  150.   17.5    1. 32.
 1
'SB OFFRAMP2'      'AG'    -315.  6005.   -315.     4808.  150.   15.8    1. 32.
2
'SB EXIT QUEUE'    'AG'    -315.  4808.   -315.     6005.   1.    12.    1
      40 20 2. 150  193.1  1800 1 3
1
'SB ONRAMP1'       'AG'    -315.  4742.   -315.     3795.   75.   17.5    1. 32.
1
'SB ONRAMP2'       'AG'    -315.  3795.    -37.     1940.   75.   22.6    1. 32.
1
'HWY 132 EB APPR1'  'AG'   -1015.  4769.   -315.     4769.  250.   17.5    1. 32.
2
'HWY 132 EB QUEUE'  'AG'    -340.  4769.   -1015.    4769.   1.   12.  1
      40 20 2. 250  193.1  1800 1 3
1
'HWY 132 EB APPR2'  'AG'    -315.  4769.     315.    4769.  300.   17.5    1. 32.
2
'HWY 132 EB QUEUE2' 'AG'     285.  4769.    -315.    4769.   1.   12.  1
      40 20 2. 350  193.1  1800 1 3
1
'HWY 132 EB DEP2'   'AG'     315.  4769.    1015.    4769.  350.    1.    12.  1
1
'HWY 132 WB APPR1'  'AG'    1015.  4781.     315.    4781.  200.   17.5    1. 32.
2
'HWY 132 WB QUEUE'  'AG'     340.  4781.    1015.    4781.   1.   12.  1
      40 20 2. 200 193.1  1800 1 3
1
'HWY 132 WB APPR2'  'AG'    -315.  4781.     315.    4781.  225.   17.5    1. 32.
2
'HWY 132 WB QUEUE2' 'AG'    -285.  4781.     315.    4781.   1.   12.    1
      40 20 2. 225  193.1  1800 1 3
1
'HWY 132 WB DEP2'   'AG'    -315.  4781.   -1015.    4781.  250.   17.5    1. 32.
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

Example 8: CAL3QHC Output

CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221 PAGE 1

JOB: FREEWAY RUN: INTERCHANGE

DATE : 4/30/ 3
TIME : 10:30:17

The MODE flag has been set to C for calculating CO averages.

SITE & METEOROLOGICAL VARIABLES

```
 VS =    .0 CM/S       VD =    .0 CM/S       Z0 =  10. CM
  U =  1.0 M/S         CLAS =   5  (E)      ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  3.0 PPM
```

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. I-15 NB1	37.0	.0	37.0	2220.0	2220.	360.	AG	4000.	22.6	1.0	44.0		
2. I-15 NB2	37.0	2220.0	37.0	7355.0	5135.	360.	BR	3900.	22.6	21.0	44.0		
3. I-15 NB3	37.0	7355.0	37.0	9325.0	1970.	360.	AG	3975.	22.6	1.0	44.0		
4. NB OFFRAMP1	37.0	2220.0	315.0	3685.0	1491.	11.	AG	100.	17.5	1.0	32.0		
5. NB OFFRAMP2	315.0	3685.0	315.0	4742.0	1057.	360.	AG	100.	15.8	1.0	32.0		
6. NB EXIT QUEUE	315.0	4742.0	315.0	4731.1	11.	180.	AG	259.	100.0	1.0	12.0	.14	.6
7. NB ONRAMP1	315.0	4781.0	315.0	5942.0	1161.	360.	AG	75.	17.5	1.0	32.0		
8. NB ONRAMP2	315.0	5942.0	37.0	7355.0	1440.	349.	AG	75.	22.6	1.0	32.0		
9. I-15 SB1	-37.0	9325.0	-37.0	7340.0	1985.	180.	AG	5000.	22.6	1.0	44.0		
10. I-15 SB2	-37.0	7340.0	-37.0	1940.0	5400.	180.	BR	4850.	22.6	21.0	44.0		
11. I-15 SB2	-37.0	1940.0	-37.0	.0	1940.	180.	AG	4925.	22.6	1.0	44.0		
12. SB OFFRAMP1	-37.0	7340.0	-315.0	6005.0	1364.	192.	AG	150.	17.5	1.0	32.0		
13. SB OFFRAMP2	-315.0	6005.0	-315.0	4808.0	1197.	180.	AG	150.	15.8	1.0	32.0		
14. SB EXIT QUEUE	-315.0	4808.0	-315.0	4824.4	16.	360.	AG	259.	100.0	1.0	12.0	.21	.8
15. SB ONRAMP1	-315.0	4742.0	-315.0	3795.0	947.	180.	AG	75.	17.5	1.0	32.0		
16. SB ONRAMP2	-315.0	3795.0	-37.0	1940.0	1876.	171.	AG	75.	22.6	1.0	32.0		
17. HWY 132 EB APPR1	-1015.0	4769.0	-315.0	4769.0	700.	90.	AG	250.	17.5	1.0	32.0		
18. HWY 132 EB QUEUE	-340.0	4769.0	-367.3	4769.0	27.	270.	AG	259.	100.0	1.0	12.0	.35	1.4
19. HWY 132 EB APPR2	-315.0	4769.0	315.0	4769.0	630.	90.	AG	300.	17.5	1.0	32.0		
20. HWY 132 EB QUEUE2	285.0	4769.0	246.7	4769.0	38.	270.	AG	259.	100.0	1.0	12.0	.49	1.9
21. HWY 132 EB DEP2	315.0	4769.0	1015.0	4769.0	700.	90.	AG	350.	1.0	12.0	1.0		
22. HWY 132 WB APPR1	1015.0	4781.0	315.0	4781.0	700.	270.	AG	200.	17.5	1.0	32.0		
23. HWY 132 WB QUEUE	340.0	4781.0	361.9	4781.0	22.	90.	AG	259.	100.0	1.0	12.0	.28	1.1
24. HWY 132 WB APPR2	-315.0	4781.0	315.0	4781.0	630.	90.	AG	225.	17.5	1.0	32.0		
25. HWY 132 WB QUEUE2	-285.0	4781.0	-260.4	4781.0	25.	90.	AG	259.	100.0	1.0	12.0	.31	1.3
26. HWY 132 WB DEP2	-315.0	4781.0	-1015.0	4781.0	700.	270.	AG	250.	17.5	1.0	32.0		

Example 8: CAL3QHC Output (cont.)

JOB: FREEWAY RUN: INTERCHANGE

DATE : 4/30/ 3
TIME : 10:30:17

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
6. NB EXIT QUEUE	40	20	2.0	100	1800	193.10	1	3
14. SB EXIT QUEUE	40	20	2.0	150	1800	193.10	1	3
18. HWY 132 EB QUEUE	40	20	2.0	250	1800	193.10	1	3
20. HWY 132 EB QUEUE2	40	20	2.0	350	1800	193.10	1	3
23. HWY 132 WB QUEUE	40	20	2.0	200	1800	193.10	1	3
25. HWY 132 WB QUEUE2	40	20	2.0	225	1800	193.10	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	556.0	4797.0	6.0
2. REC 2	481.0	4797.0	6.0
3. REC 3	406.0	4797.0	6.0
4. REC 4	331.0	4797.0	6.0
5. REC 5	299.0	4797.0	6.0
6. REC 6	224.0	4797.0	6.0
7. REC 7	149.0	4797.0	6.0
8. REC 8	74.0	4797.0	6.0
9. REC 9	-74.0	4797.0	6.0
10. REC 10	-149.0	4797.0	6.0
11. REC 11	-224.0	4797.0	6.0
12. REC 12	-299.0	4797.0	6.0
13. REC 13	-331.0	4797.0	6.0
14. REC 14	-406.0	4797.0	6.0
15. REC 15	-481.0	4797.0	6.0
16. REC 16	-556.0	4797.0	6.0
17. REC 17	-556.0	4753.0	6.0
18. REC 18	-481.0	4753.0	6.0
19. REC 19	-406.0	4753.0	6.0
20. REC 20	-331.0	4753.0	6.0
21. REC 21	-299.0	4753.0	6.0
22. REC 22	-244.0	4753.0	6.0
23. REC 23	-149.0	4753.0	6.0
24. REC 24	-74.0	4753.0	6.0
25. REC 25	74.0	4753.0	6.0
26. REC 26	149.0	4753.0	6.0

Example 8: CAL3QHC Output (cont.)

```
     27. REC 27               *       224.0     4753.0        6.0   *
    28. REC 28               *       299.0     4753.0        6.0   *
     29. REC 29               *       331.0     4753.0        6.0   *
     30. REC 30               *       406.0     4753.0        6.0   *
     31. REC 31               *       481.0     4753.0        6.0   *
     32. REC 32               *       556.0     4753.0        6.0   *
```

Example 8: CAL3QHC Output (cont.)

JOB: FREEWAY RUN: INTERCHANGE

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	*	3.6	3.7	4.1	4.6	4.7	5.6	5.9	5.1	4.9	4.3	3.8	3.7	5.8	4.7	4.4	4.3	3.8	3.5	3.8	4.1
10.	*	3.0	3.0	3.0	3.1	3.1	3.5	3.8	3.4	3.4	3.3	3.1	3.1	7.3	6.1	5.5	5.7	5.0	4.7	4.8	5.2
20.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.3	3.3	3.4	3.1	3.1	6.5	5.8	5.3	5.6	5.1	4.8	5.0	5.4
30.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.3	3.4	3.5	3.1	3.1	6.0	5.4	5.0	5.4	4.7	4.5	4.8	5.0
40.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.5	3.6	3.5	3.1	3.1	5.6	5.2	4.8	5.3	4.5	4.4	4.7	4.8
50.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.3	3.6	3.8	3.4	3.1	3.1	5.3	4.9	4.7	5.0	4.4	4.2	4.6	4.9
60.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.9	4.0	3.2	3.1	3.1	5.2	4.8	4.6	4.8	4.4	4.2	4.6	5.1
70.	*	3.0	3.0	3.0	3.0	3.0	3.0	3.6	4.2	4.2	3.2	3.2	3.2	5.0	4.7	4.5	4.5	4.4	4.2	4.8	5.2
80.	*	3.1	3.1	3.1	3.2	3.2	3.1	3.7	4.0	3.9	3.2	3.2	3.2	5.1	4.9	4.7	4.6	4.6	4.3	4.9	5.2
90.	*	3.2	3.2	3.2	3.3	3.3	3.5	3.5	3.5	3.5	3.1	3.1	3.1	5.5	5.2	5.1	4.9	4.8	4.8	4.8	5.0
100.	*	3.3	3.3	3.4	3.6	3.6	3.7	3.2	3.2	3.2	3.0	3.0	3.0	5.5	5.3	5.3	5.3	5.0	4.9	4.4	4.4
110.	*	3.2	3.2	3.6	3.7	3.7	3.5	3.0	3.0	3.1	3.0	3.0	3.0	5.5	5.2	5.4	5.1	5.0	4.8	4.2	4.3
120.	*	3.2	3.2	3.7	3.8	3.8	3.5	3.0	3.0	3.0	3.0	3.0	3.0	5.6	5.2	5.6	5.1	5.1	4.6	4.2	4.4
130.	*	3.2	3.2	3.8	3.9	3.8	3.4	3.0	3.0	3.0	3.0	3.0	3.0	5.7	5.3	5.6	4.9	4.9	4.6	4.2	4.4
140.	*	3.1	3.1	3.6	3.8	3.7	3.4	3.0	3.0	3.0	3.0	3.0	3.0	6.0	5.6	5.5	5.0	4.9	4.7	4.4	4.5
150.	*	3.1	3.1	3.5	3.6	3.5	3.3	3.0	3.0	3.0	3.0	3.0	3.0	6.3	5.7	5.5	5.2	5.0	4.8	4.5	4.7
160.	*	3.1	3.1	3.3	3.3	3.3	3.2	3.0	3.0	3.0	3.0	3.0	3.0	6.7	6.0	5.7	5.4	5.2	5.1	4.9	4.9
170.	*	3.1	3.1	3.2	3.4	3.4	3.7	3.5	3.2	3.2	3.0	3.0	3.0	7.5	6.4	5.8	5.7	5.2	4.9	4.7	5.0
180.	*	3.7	3.9	4.4	4.9	4.9	5.9	5.7	4.7	4.7	4.1	3.7	3.6	6.1	5.1	4.5	4.6	4.1	3.9	3.6	3.7
190.	*	4.7	5.1	5.6	6.2	6.3	7.4	7.2	6.1	6.0	5.6	5.0	4.6	3.8	3.4	3.3	3.4	3.2	3.2	3.0	3.0
200.	*	4.8	5.1	5.3	5.9	5.9	6.7	6.5	5.7	5.6	5.4	5.0	4.7	3.2	3.2	3.2	3.5	3.2	3.2	3.0	3.0
210.	*	4.6	4.8	5.2	5.6	5.6	6.2	5.9	5.3	5.3	5.3	4.7	4.5	3.3	3.3	3.3	3.7	3.3	3.3	3.0	3.0
220.	*	4.4	4.6	5.1	5.5	5.5	6.0	5.6	5.1	5.1	5.1	4.5	4.3	3.4	3.4	3.5	3.8	3.3	3.3	3.0	3.0
230.	*	4.5	4.6	5.0	5.3	5.3	5.7	5.3	4.9	4.9	4.9	4.3	4.3	3.4	3.5	3.5	3.8	3.4	3.4	3.0	3.0
240.	*	4.4	4.7	5.2	5.2	5.2	5.5	5.1	4.8	4.8	4.8	4.3	4.2	3.4	3.6	3.8	3.6	3.4	3.4	3.0	3.0
250.	*	4.3	5.0	5.3	5.2	5.2	5.5	5.1	4.8	4.8	4.6	4.3	4.1	3.5	4.0	3.7	3.6	3.5	3.5	3.0	3.0
260.	*	4.7	5.1	5.1	5.2	5.3	5.5	5.2	4.9	4.8	4.5	4.5	4.2	3.8	3.9	3.7	3.5	3.5	3.5	3.1	3.1
270.	*	4.7	4.8	4.9	5.2	5.2	5.5	5.4	5.1	5.1	5.0	4.7	4.5	3.6	3.7	3.5	3.4	3.4	3.4	3.4	3.4
280.	*	4.2	4.6	4.5	4.8	4.9	5.1	5.6	5.3	5.2	5.1	4.9	4.6	3.1	3.3	3.1	3.1	3.1	3.1	3.5	3.5
290.	*	4.1	4.3	4.5	4.7	4.7	5.0	5.5	5.2	5.2	5.3	4.9	4.3	3.0	3.1	3.1	3.0	3.0	3.0	3.5	3.5
300.	*	4.2	4.3	4.5	4.8	4.8	5.1	5.6	5.3	5.3	5.0	4.6	4.3	3.0	3.0	3.3	3.0	3.0	3.0	3.4	3.4
310.	*	4.3	4.3	4.6	4.9	4.9	5.3	5.6	5.2	5.2	4.8	4.5	4.4	3.0	3.0	3.5	3.0	3.0	3.0	3.4	3.4
320.	*	4.3	4.5	4.8	5.1	5.1	5.6	5.9	5.4	5.4	4.9	4.7	4.4	3.0	3.0	3.6	3.0	3.0	3.0	3.3	3.3

Example 8: CAL3QHC Output (cont.)

```
 330.  *   4.5   4.7   5.0   5.3   5.3   5.9   6.2   5.6   5.6   5.2   4.8   4.6   3.0   3.0   3.5   3.0   3.0   3.0   3.3   3.3
 340.  *   4.7   4.9   5.3   5.6   5.7   6.5   6.8   6.0   5.9   5.4   5.0   4.9   3.0   3.1   3.4   3.0   3.0   3.0   3.2   3.2
 350.  *   4.6   5.0   5.3   6.0   6.1   7.1   7.4   6.5   6.3   5.4   5.0   4.8   3.5   3.3   3.3   3.1   3.0   3.0   3.2   3.2
 360.  *   3.6   3.7   4.1   4.6   4.7   5.6   5.9   5.1   4.9   4.3   3.8   3.7   5.8   4.7   4.4   4.3   3.8   3.5   3.8   4.1
 ------*--------------------------------------------------------------------------------------------------------------------------
 MAX   *   4.8   5.1   5.6   6.2   6.3   7.4   7.4   6.5   6.3   5.6   5.0   4.9   7.5   6.4   5.8   5.7   5.2   5.1   5.0   5.4
 DEGR. *  200   190   190   190   190   190   350   350   350   190   190   340   170   170   170    10   160   160    20    20
```

Example 8: CAL3QHC Output (cont.)

JOB: FREEWAY RUN: INTERCHANGE

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	*	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32
		CONCENTRATION (PPM)											
0.	*	4.7	4.9	6.4	10.3	9.7	6.2	5.0	4.5	4.1	3.7	3.4	3.3
10.	*	6.4	7.1	8.5	11.6	3.9	3.4	3.3	3.4	3.2	3.1	3.1	3.1
20.	*	6.0	6.2	7.2	8.7	3.3	3.3	3.3	3.4	3.4	3.1	3.1	3.1
30.	*	5.9	5.8	6.4	7.4	3.3	3.3	3.3	3.4	3.6	3.1	3.1	3.1
40.	*	5.8	5.5	6.0	6.5	3.3	3.3	3.4	3.2	3.6	3.1	3.1	3.1
50.	*	5.7	5.2	5.7	6.1	3.3	3.3	3.6	3.4	3.4	3.1	3.1	3.1
60.	*	5.3	5.3	5.7	5.8	3.5	3.5	4.1	3.6	3.2	3.1	3.1	3.1
70.	*	5.2	5.3	5.7	5.8	3.6	3.7	4.4	3.5	3.2	3.2	3.2	3.2
80.	*	5.2	5.4	5.7	5.8	3.9	4.0	4.1	3.3	3.2	3.2	3.2	3.2
90.	*	5.1	5.2	5.6	5.8	3.6	3.6	3.4	3.2	3.1	3.1	3.1	3.1
100.	*	4.6	4.8	5.1	5.2	3.1	3.1	3.2	3.0	3.0	3.0	3.0	3.0
110.	*	4.6	4.7	5.1	5.2	3.0	3.0	3.1	3.1	3.0	3.0	3.0	3.0
120.	*	4.6	4.8	5.2	5.3	3.0	3.0	3.0	3.3	3.0	3.0	3.0	3.0
130.	*	4.9	4.9	5.4	5.8	3.0	3.0	3.0	3.5	3.0	3.0	3.0	3.0
140.	*	5.0	5.2	5.7	6.2	3.0	3.0	3.0	3.6	3.0	3.0	3.0	3.0
150.	*	5.2	5.5	6.1	7.1	3.0	3.0	3.0	3.4	3.0	3.0	3.0	3.0
160.	*	5.6	5.9	6.9	8.4	3.0	3.0	3.0	3.2	3.0	3.0	3.0	3.0
170.	*	6.2	6.6	8.1	11.3	3.6	3.1	3.0	3.1	3.0	3.0	3.0	3.0
180.	*	4.3	4.6	6.2	10.1	9.5	5.9	4.8	4.3	4.0	3.6	3.3	3.2
190.	*	3.1	3.0	3.1	3.7	10.8	8.0	6.8	6.0	6.0	5.4	5.1	4.8
200.	*	3.1	3.0	3.0	3.0	8.2	6.8	6.0	5.5	5.6	5.1	4.9	4.9
210.	*	3.1	3.0	3.0	3.0	7.0	6.1	5.5	5.1	5.5	4.9	4.7	4.5
220.	*	3.0	3.0	3.0	3.0	6.1	5.6	5.3	4.9	5.4	4.7	4.5	4.3
230.	*	3.0	3.0	3.0	3.0	5.8	5.3	5.0	4.8	5.2	4.4	4.3	4.3
240.	*	3.0	3.0	3.0	3.0	5.4	5.2	4.8	4.7	4.8	4.5	4.3	4.2
250.	*	3.0	3.0	3.0	3.0	5.2	5.0	4.7	4.5	4.6	4.6	4.3	4.1
260.	*	3.1	3.1	3.1	3.1	5.2	5.2	4.8	4.6	4.6	4.4	4.3	4.1
270.	*	3.7	3.7	3.7	3.7	5.7	5.7	5.4	5.2	5.3	4.8	4.7	4.5
280.	*	4.2	3.9	3.9	4.0	5.8	5.8	5.4	5.5	5.6	5.1	4.8	4.6
290.	*	3.9	3.7	3.8	3.6	5.8	5.6	5.3	5.9	5.4	5.1	4.6	4.3
300.	*	3.7	3.7	3.5	3.5	5.9	5.7	5.3	6.1	5.0	4.9	4.4	4.3
310.	*	3.3	3.9	3.3	3.3	6.1	5.6	5.3	5.8	4.9	4.6	4.4	4.4
320.	*	3.3	3.9	3.3	3.3	6.4	5.9	5.6	5.5	5.0	4.8	4.6	4.4

Example 8: CAL3QHC Output (cont.)

```
330.  *   3.4   3.7   3.3   3.3   7.3   6.4   5.8   5.5   5.3   5.0   4.8   4.6
340.  *   3.6   3.5   3.3   3.3   8.5   7.0   6.3   5.8   5.5   5.2   5.1   4.9
350.  *   3.6   3.4   3.4   4.0  11.2   8.2   7.1   6.5   6.0   5.4   5.1   4.7
360.  *   4.7   4.9   6.4  10.3   9.7   6.2   5.0   4.5   4.1   3.7   3.4   3.3
------*------------------------------------------------------------------------
MAX   *   6.4   7.1   8.5  11.6  11.2   8.2   7.1   6.5   6.0   5.4   5.1   4.9
DEGR. *   10    10    10    10   350   350   350   350   190   190   190   200

THE HIGHEST CONCENTRATION OF   11.60 PPM OCCURRED AT RECEPTOR REC24.
```

Appendix A: Statewide Emission Rates by County

Figure 1: Utah Counties

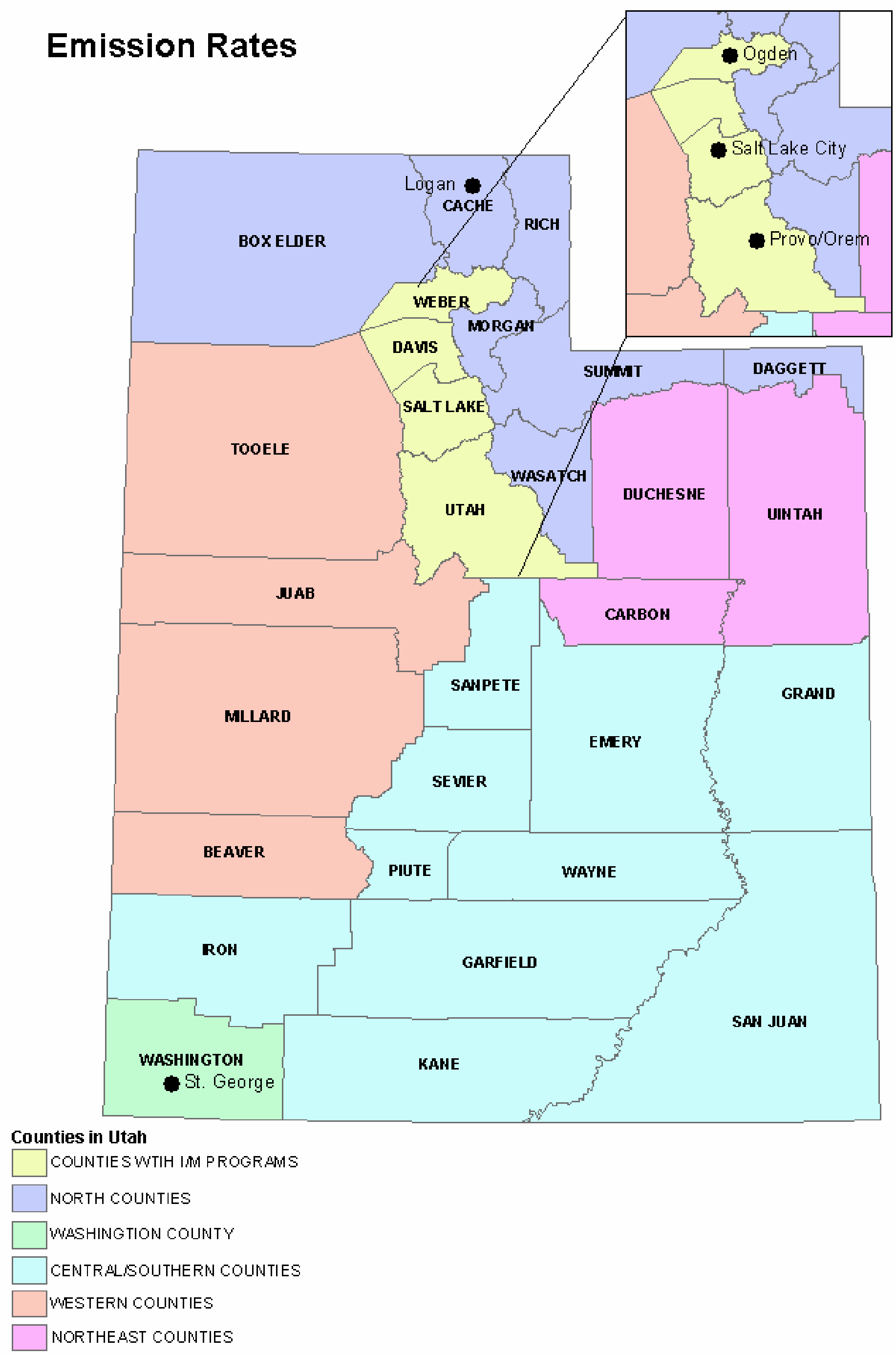


Table 1: Salt Lake County Emission Rates

Running CO Emission Rates (grams/mile)

	Interstate	Principal Arterial	Minor Arterial	Collector	Local
YEAR	65 mph	45 mph	35 mph	30 mph	25 mph
2003	16.3	12.3	10.9	11.0	10.6
2004	14.4	10.9	9.7	9.7	9.3
2005	14.2	10.7	9.5	9.6	9.2
2006	14.0	10.6	9.4	9.4	9.1
2007	11.5	8.7	7.7	7.8	7.4
2008	10.1	7.5	6.7	6.8	6.3
2009	9.5	7.1	6.3	6.4	6.1
2010	9.1	6.8	6.0	6.1	5.8
2020	6.5	4.8	4.2	4.3	4.1
2030	6.2	4.5	4.0	4.0	3.9
2040	6.1	4.5	4.0	4.0	3.8
2050	6.1	4.5	4.0	4.0	3.8

*typical winter day

Idle CO Emission Rates (grams/hour)**

	Interstate	Arterials	Local
YEAR	0 mph	0 mph	0 mph
2003	128.6	126.7	116.5
2004	113.4	111.5	101.3
2005	111.1	109.4	100.3
2006	108.9	107.2	98.2
2007	90.8	89.0	79.4
2008	78.8	77.1	68.1
2009	73.6	72.3	64.9
2010	69.4	68.1	61.3
2020	48.1	47.2	42.3
2030	45.3	44.4	39.9
2040	44.9	44.1	39.6
2050	44.9	44.1	39.6

*Based on average Salt Lake County Winter temp of Min 23 and Max 45 degrees F.
**Emission rate at 2.5 mph multiplied by 2.5

Table 2: Weber County Emission Rates

Running CO Emission Rates (grams/mile)

	Interstate	Principal Arterial	Minor Arterial	Collector	Local
YEAR	65 mph	45 mph	35 mph	30 mph	25 mph
2003	17.6	13.4	12.0	12.0	11.8
2004	15.7	12.0	10.7	10.8	10.5
2005	15.4	11.8	10.5	10.6	10.4
2006	15.2	11.6	10.3	10.4	10.2
2007	12.7	9.7	8.7	8.8	8.5
2008	11.3	8.6	7.7	7.8	7.5
2009	10.7	8.2	7.3	7.4	7.2
2010	10.3	7.8	7.0	7.1	6.9
2020	7.6	5.7	5.1	5.2	5.1
2030	7.2	5.4	4.8	4.9	4.8
2040	7.2	5.4	4.8	4.8	4.8
2050	7.2	5.4	4.8	4.8	4.8

*typical winter day

Idle CO Emission Rates (grams/hour)**

	Interstate	Arterials	Local
YEAR	0 mph	0 mph	0 mph
2003	142.9	141.0	131.1
2004	126.8	124.9	115.1
2005	124.3	122.6	113.9
2006	121.5	119.9	111.3
2007	103.3	101.6	92.6
2008	90.9	89.4	80.9
2009	85.5	84.2	77.5
2010	81.1	80.0	73.7
2020	58.1	57.3	52.9
2030	54.8	54.1	50.1
2040	54.4	53.7	49.8
2050	54.4	53.7	49.8

* based on average Weber County Winter temp of Min 26 and Max 45 degrees F.

**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 3: Davis County Emission Rates

Running CO Emission Rates (grams/mile)

	Interstate	Principal Arterial	Minor Arterial	Collector	Local
YEAR	65 mph	45 mph	35 mph	30 mph	25 mph
2003	17.5	13.4	11.9	12.0	11.7
2004	15.7	11.9	10.7	10.7	10.4
2005	15.5	11.8	10.5	10.6	10.3
2006	15.2	11.6	10.4	10.4	10.2
2007	12.8	9.7	8.7	8.8	8.5
2008	11.3	8.6	7.7	7.8	7.5
2009	10.8	8.2	7.4	7.4	7.3
2010	10.4	7.9	7.1	7.1	7.0
2020	7.7	5.8	5.2	5.2	5.2
2030	7.3	5.5	4.9	4.9	4.9
2040	7.3	5.5	4.9	4.9	4.9
2050	7.3	5.5	4.9	4.9	4.9

*typical winter day

Idle CO Emission Rates (grams/hour)**

	Interstate	Arterials	Local
YEAR	0 mph	0 mph	0 mph
2003	141.9	140.0	130.0
2004	126.0	124.1	114.1
2005	124.0	122.3	113.4
2006	121.4	119.8	111.1
2007	103.3	101.6	92.5
2008	91.2	89.6	81.0
2009	85.9	84.6	77.8
2010	81.6	80.5	74.2
2020	59.0	58.1	53.8
2030	55.6	54.9	50.9
2040	55.2	54.5	50.6
2050	55.2	54.5	50.6

*Based on average Weber County Winter temp of Min 23 and Max 45 degrees F.

**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 4: Utah County Emission Rates

Running CO Emission Rates (grams/mile)

	Interstate	Principal Arterial	Minor Arterial	Collector	Local
YEAR	65 mph	45 mph	35 mph	30 mph	25 mph
2003	18.9	14.6	12.8	12.7	12.8
2004	16.8	12.9	11.3	11.3	11.3
2005	16.6	12.8	11.2	11.1	11.2
2006	17.5	13.4	11.7	11.7	11.7
2007	14.4	11.0	9.7	9.7	9.6
2008	12.6	9.6	8.5	8.5	8.3
2009	12.0	9.1	8.1	8.0	8.0
2010	11.5	8.7	7.7	7.7	7.6
2020	8.0	6.0	5.3	5.3	5.2
2030	7.5	5.5	4.9	4.8	4.8
2040	7.4	5.5	4.8	4.8	4.8
2050	7.4	5.5	4.8	4.8	4.8

*typical winter day

Idle CO Emission Rates (grams/hr)**

	Interstate	Arterials	Local
YEAR	0 mph	0 mph	0 mph
2003	148.8	146.5	142.3
2004	131.2	128.7	124.3
2005	128.5	126.4	122.6
2006†	136.4	133.5	128.3
2007	148.8	126.4	104.3
2008	99.1	95.9	90.2
2009	92.8	126.4	85.9
2010	87.6	85.3	81.2
2020	58.8	57.0	53.9
2030	54.3	52.6	49.7
2040	53.9	52.2	49.4
2050	53.9	52.2	49.4

*Based on average Utah County Winter temp of Min 12 and Max 32 degrees F.
**Emission rate at 2.5 mph multiplied by 2.5.
†Oxygenated fuels up to 2005 as of 2006 – no Oxygenated fuels.

Table 5: Northern Counties Emission Rates
Box Elder, Cache, Rich, Morgan, Summit, Daggett, and Wasatch Counties

Running CO Emission Rates (grams/mile)

YEAR	Interstate	Principal Arterial	Minor Arterial	Collector	Local
	65 mph	45 mph	35 mph	30 mph	25 mph
2003	24.2	19.0	17.1	17.3	18.0
2004	21.9	17.1	15.4	15.6	16.3
2005	21.4	16.8	15.2	15.3	16.1
2006	21.0	16.5	14.9	15.0	15.7
2007	18.3	14.2	12.9	13.0	13.6
2008	16.5	12.8	11.6	11.8	12.3
2009	15.6	12.3	11.1	11.2	11.8
2010	15.0	11.9	10.7	10.8	11.3
2020	11.2	8.8	8.0	8.0	8.4
2030	10.5	8.2	7.4	7.5	7.9
2040	10.4	8.2	7.4	7.4	7.8
2050	10.4	8.2	7.4	7.4	7.8

*typical winter day

Idle CO Emission Rates (grams/hr)*

	Interstate	Arterials	Local
YEAR	2.5 mph	2.5 mph	2.5 mph
2003	216.8	207.8	205.9
2004	185.1	185.7	183.7
2005	189.8	182.0	180.4
2006	184.5	176.7	175.0
2007	162.1	153.2	151.2
2008	145.2	136.4	134.5
2009	135.1	129.0	127.7
2010	93.3	89.6	88.8
2020	87.1	83.6	82.8
2030	86.3	83.0	82.3
2040	86.3	83.0	82.3
2050	86.3	83.0	82.3

* Based on average Cache County Winter temp of Min 12 and Max 31 degrees F.

**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 6: Washington County Emission Rates

Running CO Emission Rates (grams/mile)

YEAR	Interstate	Principal Arterial	Minor Arterial	Collector	Local
	65 mph	45 mph	35 mph	30 mph	25 mph
2003	21.5	16.6	15.0	15.2	15.8
2004	19.5	15.0	13.6	13.7	14.3
2005	19.0	14.7	13.3	13.5	14.1
2006	18.7	14.5	13.1	13.2	13.8
2007	16.3	12.5	11.3	11.5	12.0
2008	14.7	11.2	10.2	10.3	10.58
2009	13.9	10.8	9.8	9.9	10.4
2010	13.4	10.4	9.4	9.6	10.0
2020	10.0	7.8	7.1	7.1	7.5
2030	9.4	7.3	6.6	6.7	70
2040	9.3	7.3	6.5	6.6	6.9
2050	9.3	7.3	6.5	6.6	6.9

*typical winter day

Idle CO Emission Rates (grams/hr)

	Interstate	Arterials	Local
YEAR	2.5 mph	2.5 mph	2.5 mph
2003	194.0	183.2	180.8
2004	174.7	163.7	161.4
2005	169.6	160.2	158.2
2006	164.9	155.6	153.6
2007	145.3	135.3	133.1
2008	129.6	120.1	118.0
2009	120.9	113.8	112.3
2010	115.4	109.2	107.8
2020	83.9	79.8	78.9
2030	78.4	74.6	73.8
2040	77.7	74.1	73.3
2050	77.7	74.1	73.3

* Based on average Washington County Winter temp of Min 25 and Max 53 degrees F.

**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 7: Central & Southern Counties Emission Rates
Piute, Iron, Sevier, Emery, Wayne, Garfield, Kane,
San Juan, Grand, and Sanpete Counties

Running CO Emission Rates (grams/mile)*

YEAR	Interstate	Principal Arterial	Minor Arterial	Collector	Local
	65 mph	45 mph	35 mph	30 mph	25 mph
2003	22.6	17.5	15.8	16.0	16.7
2004	20.4	15.8	14.3	14.5	15.1
2005	20.0	15.6	14.1	14.2	14.9
2006	19.6	15.3	13.8	13.9	14.6
2007	17.0	13.2	11.9	12.1	12.6
2008	15.4	11.8	10.8	10.9	11.4
2009	14.6	11.4	10.3	10.4	10.9
2010	14.0	11.0	9.9	10.0	10.5
2020	10.5	8.2	7.4	7.5	7.8
2030	9.8	7.6	6.9	7.0	7.3
2040	9.7	7.6	6.8	6.9	7.3
2050	9.7	7.6	6.8	6.9	7.3

*typical winter day

Idle CO Emission Rates (grams/hr)**

	Interstate	Arterials	Local
YEAR	2.5 mph	2.5 mph	2.5 mph
2003	203.2	193.1	191.0
2004	182.9	172.5	170.3
2005	177.7	168.9	167.0
2006	172.6	163.9	162.1
2007	151.9	142.3	140.2
2008	135.8	126.5	124.5
2009	126.3	119.7	118.2
2010	120.3	114.4	113.2
2020	87.3	83.3	82.4
2030	81.5	77.8	77.0
2040	80.8	77.2	76.5
2050	80.8	77.2	76.5

*Based on average Central/Southeast Counties Winter temp of Min 14 and Max 41 degrees F.
**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 8: Northeastern Counties Emission Rates
Uintah, Carbon, and Duchesne Counties

Running CO Emission Rates (grams/mile)

YEAR	Interstate	Principal Arterial	Minor Arterial	Collector	Local
	65 mph	45 mph	35 mph	30 mph	25 mph
2003	25.3	20.0	18.0	18.1	19.0
2004	22.9	18.0	16.2	16.4	17.1
2005	22.4	17.7	16.0	16.1	16.9
2006	22.0	17.4	15.7	15.8	16.5
2007	19.1	15.0	13.5	13.7	14.3
2008	17.3	13.5	12.2	12.4	12.9
2009	16.4	12.9	11.7	11.8	12.4
2010	15.7	12.5	11.3	11.4	11.9
2020	11.7	9.3	8.3	8.4	8.8
2030	11.0	8.6	7.8	7.8	8.2
2040	10.9	8.6	7.7	7.8	8.2
2050	10.9	8.6	7.7	7.8	8.2

*typical winter day

Idle CO Emission Rates (grams/hr)*

	Interstate	Arterials	Local
YEAR	2.5 mph	2.5 mph	2.5 mph
2003	226.1	217.9	216.1
2004	203.4	194.7	192.9
2005	198.1	191.0	189.5
2006	192.6	185.4	183.9
2007	169.0	160.6	158.8
2008	151.6	143.2	141.3
2009	141.1	135.5	134.2
2010	134.4	129.4	128.4
2020	97.3	93.9	93.1
2030	90.8	87.5	86.8
2040	90.1	86.9	86.3
2050	90.1	86.9	86.3

*Based on average Northeast Counties Winter temp of Min 4 and Max 29 degrees F.
**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Table 9: Western Counties Emission Rates
Tooele, Juab, Millard and Beaver Counties

Running CO Emission Rates (grams/mile)

YEAR	Interstate	Principal Arterial	Minor Arterial	Collector	Local
	65 mph	45 mph	35 mph	30 mph	25 mph
2003	23.1	18.0	16.2	16.4	17.1
2004	20.9	16.2	14.7	14.8	15.5
2005	20.4	16.0	14.4	14.6	15.2
2006	20.0	15.7	14.1	14.3	14.9
2007	17.4	13.5	12.2	12.4	13.0
2008	15.8	12.1	11.0	11.2	11.7
2009	14.9	11.7	10.6	10.7	11.2
2010	14.3	11.2	10.2	10.3	10.8
2020	10.7	8.4	7.6	7.6	8.0
2030	10.0	7.8	7.0	7.1	7.5
2040	9.9	7.8	7.0	7.1	7.4
2050	9.9	7.8	7.0	7.1	7.4

*typical winter day

Idle CO Emission Rates (grams/hr)*

	Interstate	Arterials	Local
YEAR	2.5 mph	2.5 mph	2.5 mph
2003	207.5	197.7	195.6
2004	186.7	176.7	174.5
2005	181.5	173.0	171.2
2006	176.4	167.9	166.1
2007	155.0	145.7	143.6
2008	138.7	129.6	127.6
2009	129.1	122.6	121.2
2010	123.0	117.2	116.0
2020	89.1	85.3	84.4
2030	83.2	79.6	78.8
2040	82.5	79.0	78.3
2050	82.5	79.0	78.3

*Based on average West Counties Winter temp of Min 13 and Max 38 degrees F.

**Emission rate at 2.5 mph multiplied by 2.5, typical winter day.

Appendix B: Data Input Example

Data entered into CAL3QHC must follow a sequence. The following is a layout of the data layout in CAL3QHC. Please refer to Table 10 for reference.

```
LINE
NUMBER    VARIABLE NAME AND INPUT SEQUENCE
  1      'JOB'  ATIM  ZO  VS  VD  NR  SCAL  IOPT  IDEBUG
  2      'RCP'  XR  YR  ZR
  3      'RUN'  NL  NM  PRINT2  'MODE'
         (Note: 'MODE' has been added to a type 3 line.
          Enter 'C' for CO or 'P' for PM calculations.)
  4      IQ  (When IQ = 2, Line Number types 5a and 5b follow)
  5a      'LNK'  'TYPE'  XL1  YL1  XL2  YL2  HL  WL  NLANES
  5b      CAVG  RAVG  YFAC  IV  IDLFAC  SFR  ST  AT
  4      IQ  (When IQ = 1, Line Number type 5c follows)
  5c      'LNK'  'TYPE'  XL1  YL1  XL2  YL2  VPHL  EFL  HL  WL
  6      U  BRG  CLAS  MIXH  AMB  'VAR'  DEGR  VAI(1)  VAI(2)
            (Note: BRG refers to the wind direction, the direction the wind
            is blowing FROM.  Lines 2, and 4 through 6 are repeated as
            necessary.)
```

Table 10: CAL3QHC Input Sequence

Character = any character **must be in single quotes** (ex. ‘Job 163’)
Real = Real number **must be followed by decimal** (ex. 1.)
Integer = any whole number (ex. 123)
Items in **bold** are default or constant values

Line Number	Title	Input Type	Input Requirement/Description
1	'JOB'	Character	Current job title (Limit of 40 Characters).
	ATIM	Real	Averaging time [min]. **default 60**
	ZO	Real	Surface roughness [cm]**. (Section 2.5)**
	VS	Real	Settling velocity [cm/s]. **default 0 (Section 4.3.1)**
	VD	Real	Deposition velocity [cm/s]. **default 0 Section (4.3.2)**
	NR	Integer	Number of receptors,max=60.
	SCAL	Real	Scale conversion factor [if units are in feet enter 0.3048, if they are in meters enter 1.0].
	IOPT	Integer	Metric to English conversion in output option. Enter "1" for output in feet. Otherwise, enter a "0" for output in meters. **Default 1**
	IDEBUG	Integer	Debugging option. Enter "1" for this option which will cause the input data to be echoed onto the screen. The echoing process stops when an error is detected. Enter a "0" if the debugging option is not wanted. **Default 1**
2	'RCP'	Character	Receptor name (Limit of 20 Characters). **(Section 2.4)**
	XR	Real	X-coordinate of receptor.
	YR	Real	Y-coordinate of receptor.
	ZR	Real	Z-coordinate of receptor.
3	'RUN'	Character	Current run title (Limit of 40 Characters).
	NL	Integer	Number of links, max=120.
	NM	Integer	Number of meteorological conditions, unlimited number. Each unique wind speed, stability class, mixing height, or wind angle range constitutes a new meteorological condition**. Usually 1 unless doing sensitivity analysis**
	PRINT2	Integer	Enter "1" for the output that includes the receptor - link matrix tables (Long format), enter "0" for the summary output (Short format). **Default 1**
	'MODE'	Character	Enter 'C' for CO or 'P' for Particulate Matter (PM) calculations. **Default ‘C’**
4	IQ	Integer	Enter "1" for free flow and "2" for queue links . If “1” line 5a will follow If “2” line 5b and 5c will follow. **(Section 2.1)**
5a-Free Flow Links	'LNK'	Character	Link description (Limit of 20 Characters).
	'TYP'	Character	Link type. Enter 'AG' for "at grade" or 'FL' for "fill," 'BR' for "bridge" and 'DP' for "depressed". **Most cases will be ‘AG’ (Section 2.1)**
	XL1	Real	Link X-coordinate for end point 1.
	YL1	Real	Link Y-coordinate for end point 1.
	XL2	Real	Link X-coordinate for end point 2.
	YL2	Real	Link Y-coordinate for end point 2.
	VPHL	Real	Traffic volume on link [veh/hr].
	EFL	Real	Emission factor [g/veh-mi**]. (See Appendix, Free Flow Emission Rates)**
	HL	Real	Source height. **Enter 1 as constant for all analysis (Section 4.3.3)**
	WL	Real	Mixing zone width (Link Width). **Width of travel Lanes plus 20 ft. (Section 2.6)**

Table 10: Continued

Line Number	Title	Input Type	Input Requirement/Description
5b-Queue Links	'LNK'	Character	Link description (Limit of 20 Characters).
	'TYP'	Character	Link type. Enter 'AG' for "at grade" or 'FL' for "fill," 'BR' for "bridge" and 'DP' for "depressed". **Most cases will be 'AG' (Section 2.1)**
	XL1	Real	Link X-coordinate for end point 1 at intersection stopping line.
	YL1	Real	Link Y-coordinate for end point 1 at intersection stopping line.
	XL2	Real	Link X-coordinate for end point 2.
	YL2	Real	Link Y-coordinate for end point 2.
	HL	Real	Source height.
	WL	Real	Mixing zone width. **Width of all traveled lanes on link**
	NLANES	Integer	Number of travel lanes in queue link.
5c-Queue Links	CAVG	Integer	Average total signal cycle length [s].
	RAVG	Integer	Average red total signal cycle length [s].
	YFAC	Real	Clearance lost time (portion of the yellow phase that is not used by motorist) [s]. **Default is 2.**
	IV	Integer	Approach volume on the queue link [veh/hr]. **total vehicles in all lanes on traveled link**
	IDLFAC	Real	Idle emission factor [g/veh-hr]. **(see Appendix table X for idle emission factor)**
	SFR	Integer	Saturation flow rate [veh/hr/lane]. **Enter 1600 for a default value. (Section 3.6)**
	ST	Integer	Signal type. Enter 1 for pre-timed, 2 for actuated, 3 for semi actuated. Enter 1 for a default value. **(Section3.1)**
	AT	Integer	Arrival rate. (Progression) Enter 1 for worst progression, 2 for below average progression, 3 for average progression, 4 for above average progression, 5 for best progression. **Enter 3 for a default value. (Section 3.7)**
6		Real	Wind speed [m/s]. **Enter 1 as constant for all analysis (Section 4.3.4)**
	BRG	Real	Wind direction (angle from which the wind is coming). Enter 0 if wind direction variation data follow. Enter actual wind direction, if only one wind direction will be used. **Enter 0 for all multi-wind direction analysis**
	CLAS	Integer	Stability class. **Enter 5 as default (Section 4.2)**
	MIXH	Real	Mixing height [m]. **Enter 1000. as default (Section 4.3.6)**
	AMB	Real	Ambient background concentration [ppm]. **(See Appendix Table X)**
	'VAR'	Character	Enter 'Y' if wind direction variation data follow. Enter 'N' if only one wind direction [BRG] will be considered. **Enter N as default**
	DEGR	Integer	Wind direction increment angle [degrees]. **Enter 10 as default**
	VAI(1)	Integer	Lower boundary of the variation range (First increment multiplier). **Enter 0 as default**
	VAI(2)	Integer	Upper boundary of the variation range (Last increment multiplier). **Enter 360 as default**

1. Introduction

According to the Environmental Protection Agency (EPA) and the Federal Highway Administration (FHWA), the carbon monoxide hot spot model CAL3QHC is generally accepted as a "screening" model. As such, the model results are reasonably accurate estimates of worst case carbon monoxide (CO) concentrations. Intersections where the modeled results are below the National Ambient Air Quality Standard can be reasonably assumed not to create violations, worsen existing violations, or delay timely attainment of the National Ambient Air Quality Standard for carbon monoxide.

On the other hand, not every intersection that is modeled above the National Ambient Air Quality Standards with CAL3QHC would result in violations of the standard, but might simply require more detailed analysis. In recognition that using the CAL3QHC model is a substantial effort in itself, many states run the model for a range of conservative situations in an effort to pre-screen projects that fall below certain traffic or geometric thresholds. The process of "pre-screening" projects allows for the technical justification to reasonably assume that broader categories of projects would not create violations of the National Ambient Air Quality Standards for CO without requiring each project to run the CAL3QHC model.

Knowledge of the interaction between intersection operations and carbon monoxide levels is necessary to categorically clear projects CAL3QHC model runs that cover wide applications. As a point of practice, FHWA has already categorically cleared projects from running the CAL3QHC model in attainment areas if the existing or future intersection Level of Service is A, B, or C, according to the procedures of the *Highway Capacity Manual*. The purpose of this section is to run the CAL3QHC model covering common applications in Utah that would allow for reasonable certainty that new or widened intersections would not create new violations of the National Ambient Air Quality Standards for carbon monoxide so that detailed intersection modeling would not be required for each case.

In order to minimize individual CAL3QHC runs, the model was run for broad categories of projects. The results of this modeling have attempted to identify traffic volume thresholds that may be different in different areas throughout the state, where any project with existing or projected traffic below the threshold traffic volume does not require detailed model runs. Other states such as Michigan have allowed threshold volumes to increase as sidewalks or public access areas are moved farther from the travel lanes. In Utah, for the application of this screening, traffic volumes are set based on the highest CO concentration, regardless of actual air quality receptors. It is still possible (and even likely given the conservative nature of this screening) that CAL3QHC model runs, when required, and actual CO concentrations for intersections above the threshold values, would not result in CO values above the National Ambient Air Quality Standards. It should be emphasized that volume thresholds identified in this section have been conservatively estimated in order to leave no doubt that traffic volumes below those estimated would not create hot spot problems.

2. Exclusions from Screening

The practice of categorically clearing projects from requiring carbon monoxide modeling on a case by case basis is supported under the Transportation Conformity Requirements, 40 CFR 93.123. In non-attainment areas, categorically clearing projects, or pre-screening projects as described in this section, requires an agreement through the interagency consultation process and approval of the EPA Regional Administrator. No such agreement or approval was developed for this manual, so the pre-screening of projects is only proposed in carbon monoxide attainment areas in Utah. Future efforts of the Utah Department of Transportation may create screening criteria in non-attainment or maintenance areas. Projects that are in or directly affect (i.e. add traffic to) the following areas are not pre-screened as of this manual:

- Salt Lake City,
- Ogden City,
- Provo City, and
- Orem City, (Orem City's attainment status is uncertain, but this manual is assuming a more conservative stance to include Orem as non-attainment area until otherwise approved by Utah DAQ, since EPA does not recognize Orem as a non-attainment area but Utah DAQ does).

Other assumptions have been made regarding directional split, peak hour factors, truck and bus percentages, turn movements, etc. Since it is unreasonable to foresee every individual circumstance when pre-screening broad categories, it is important to identify specific circumstances that are not covered by the screening described in this section. Projects that display the following unique characteristics may still require individual model runs of the CAL3QHC model:

- Locations of truck or bus terminals or other unique vehicle mixes,
- 4-way intersections with a single predominant turn movement,
- Intersections with significantly skewed angles (beyond approximately 75-105 degrees),
- Intersections serving major special events or other cases with unique peak hour factors,
- Intersections with split phasing due to shared left turn and through traffic movements.

3. Intersection Screening

Intersection screening has been performed for two cross streets that consist of one travel lane in each direction, two travel lanes in each direction, and three travel lanes in each direction. Intersections that consist of two travel lanes in each direction on one cross street and one travel lane in each direction on the other cross street, could apply the volume thresholds for each appropriate cross street. For screening, volumes on each cross street have been assumed equal, to reflect the worst case situation. The presence of right turn lanes or dual left turn lanes does not affect the screening since they would generally result in reductions to vehicle delay and corresponding decreases from the worst case modeled assumptions used for pre-screening.

The following assumptions have been used for pre-screening. Actual data and traffic characteristics will likely vary from these assumptions. As a general guideline, variations that reduce peak hour traffic or improve the peak hour level of service will result in actual hot spot concentrations falling below the modeled pre-screened values.

- 60/40 directional split
- 12 percent peak hour factor
- 10 percent (each) right and left turn volumes
- Standard road cross sections (12 foot travel lanes and 14 foot turn lanes)

4. Mainline Screening

Generally speaking, intersections will always be the controlling factor for carbon monoxide hot spot analysis. Mainline sections with infrequent but allowable intersections will generally have higher CO concentrations due to the added idling of the cross street traffic at the intersection. Although the idling of stop controlled intersections may be relatively minor in many applications, there has been an increasing concern for air quality analysis reviewers in Utah when no intersections are projected to result at a level of service D or worse. Therefore, mainline section screening has been performed to identify mainline volumes at locations of minor stop controlled intersections so that volume thresholds may be established to increase the confidence of air quality analysis for reviewers. Mainline section pre-screening analysis has assumed a variety of assumptions similar to intersections. Pre-screened traffic volumes on the mainline are generally much greater than traffic volumes at intersections, but are provided to demonstrate a practical limit for which case specific modeling may not be necessary. The following assumptions have been made for mainline pre-screened values:

- 60/40 directional split on the mainline
- 12 percent peak hour factor on the mainline
- 100 right turns, 100 left turns both to and from the mainline to the minor cross street
- Standard road cross sections with 12 foot travel lanes, 12 foot turn medians on the mainline
- 24 foot pavement width on the minor street

5. Geography

In order to cover a wide range of applications in Utah, geographically unique estimates of background concentrations and emission rates were used. In some cases, pre-screening was performed which combined many areas with varying emissions rates or background values. In these cases, the highest estimated emission rates and background values were used. Pre-screening traffic volumes apply differently to the following areas in Utah:

- Salt Lake County, outside Salt Lake City;
- Utah County, outside Provo and Orem Cities;
- Weber County, outside Ogden City;
- Davis County;
- Logan City;
- St. George City;
- All other areas (except non-attainment areas).

6. Pre-screening Results

The following represents the maximum average daily traffic volumes that can be considered pre-screened by the CAL3QHC model. Traffic volumes below these levels are expected not to create hot spot concentrations near the National Ambient Air Quality Standards for CO. Traffic volumes above these levels will likely require additional analysis such as detailed runs of the CAL3QHC model.

Maximum Intersection Traffic Volumes
That Do Not Require CAL3QHC Modeling

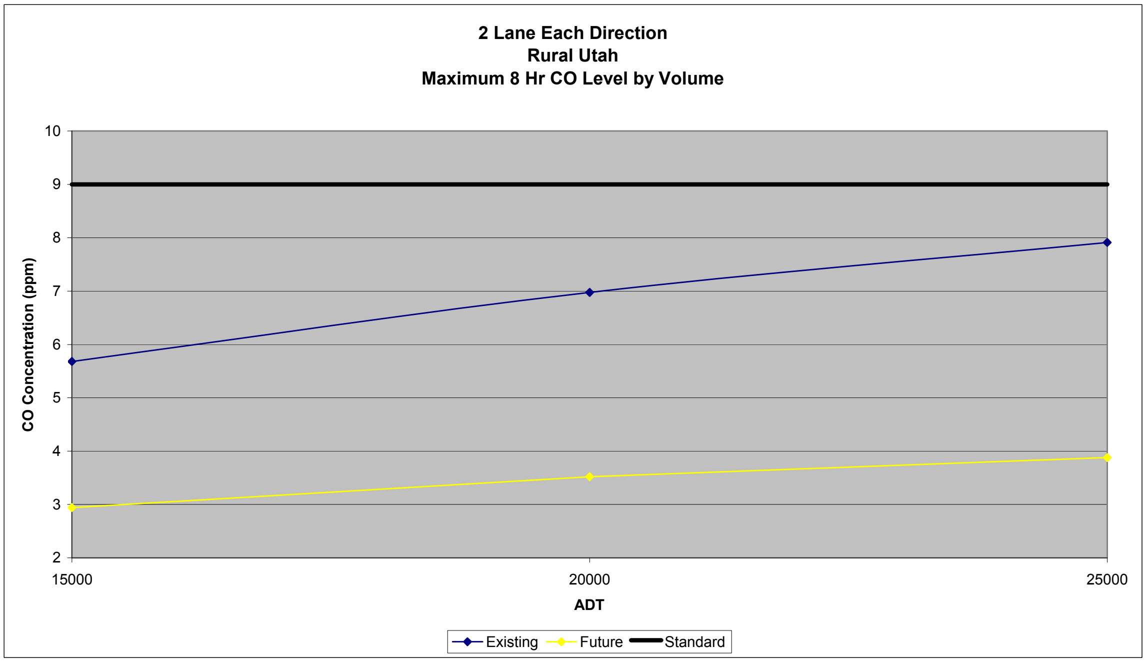
	Existing Traffic			20+ Year Traffic Forecast		
	1 Lane	2 Lanes	3 Lanes	1 Lane	2 Lanes	3 Lanes
Salt Lake County (outside Salt Lake City)	15,000	15,000	15,000	25,000	45,000	45,000
Utah County (outside Provo and Orem)	20,000	25,000	25,000	25,000	45,000	45,000
Weber County (outside Ogden City)	25,000	35,000	35,000	30,000	45,000	45,000
Davis County	20,000	25,000	25,000	25,000	45,000	45,000
Logan City	15,000	15,000	15,000	25,000	45,000	45,000
St. George City	20,000	25,000	25,000	30,000	45,000	45,000
All Other Attainment Areas	25,000	30,000	30,000	30,000	45,000	45,000

Note: Number of lanes refers to number of travel lanes in each direction, not including turn lanes. Traffic volumes expressed in average weekday daily traffic.

Maximum Mainline Traffic Volumes
That Do Not Require CAL3QHC Modeling

	Existing Traffic			20+ Year Traffic Forecast		
	1 Lane	2 Lanes	3 Lanes	1 Lane	2 Lanes	3 Lanes
Salt Lake County (outside Salt Lake City)	25,000	25,000	25,000	30,000	50,000	50,000
Utah County (outside Provo and Orem)	30,000	30,000	35,000	30,000	50,000	50,000
Weber County (outside Ogden City)	30,000	35,000	35,000	30,000	50,000	50,000
Davis County	30,000	30,000	30,000	30,000	50,000	50,000
Logan City	15,000	20,000	20.000	30,000	45,000	45,000
St. George City	30,000	30,000	30,000	30,000	50,000	50,000
All Other Attainment Areas	30,000	30,000	35,000	30,000	50,000	50,000

Note: Number of lanes refers to number of travel lanes in each direction, not including turn lanes. Traffic volumes expressed in average weekday daily traffic.


2 Lane Each Direction
Rural Utah
Maximum 8 Hr CO Level by Volume
CO Concentration (ppm)
10
9
8
7
6
5
4
3
2
15000
20000
25000
ADT
Existing
Future
Standard

CAL3QHC Screening
Input

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

```
'1 LANE UtCo 15K fu' 60. 108.  0.  0.  52   0.3048 1 1
'REC 1'        29.    29.    6.
'REC 2'        29.    104.   6.
'REC 3'        29.    179.   6.
'REC 4'        29.    254.   6.
'REC 5'        29.    329.   6.
'REC 6'        29.    404.   6.
'REC 7'        29.    479.   6.
'REC 8'        29.    -29.   6.
'REC 9'        29.    -104.  6.
'REC 10'       29.    -174.  6.
'REC 11'       29.    -254.  6.
'REC 12'       29.    -329.  6.
'REC 13'       29.    -404.  6.
'REC 14'       29.    -479.  6.
'REC 15'       -29.   29.    6.
'REC 16'       -29.   104.   6.
'REC 17'       -29.   179.   6.
'REC 18'       -29.   254.   6.
'REC 19'       -29.   329.   6.
'REC 20'       -29.   404.   6.
'REC 21'       -29.   479.   6.
'REC 22'       -29.   -29.   6.
'REC 23'       -29.   -104.  6.
'REC 24'       -29.   -179.  6.
'REC 25'       -29.   -254.  6.
'REC 26'       -29.   -329.  6.
'REC 27'        -29.  -404.  6.
'REC 28'       -29.   -479.  6.
'REC 30'       104.   29.    6.
'REC 31'       179.   29.    6.
'REC 32'       254.   29.    6.
'REC 33'       329.   29.    6.
'REC 34'       404.   29.    6.
'REC 35'       479.   29.    6.
'REC 37'       -104.  29.    6.
'REC 38'       -179.  29.    6.
'REC 39'       -254.  29.    6.
'REC 40'       -329.  29.    6.
'REC 41'       -404.  29.    6.
'REC 42'       -479.  29.    6.
'REC 44'       104.   -29.   6.
'REC 45'       179.   -29.   6.
'REC 46'       254.   -29.   6.
'REC 47'       329.   -29.   6.
'REC 48'       404.   -29.   6.
'REC 49'       479.   -29.   6.
'REC 51'       -104.  -29.   6.
'REC 52'       -179.  -29.   6.
'REC 53'       -254.  -29.   6.
'REC 54'       -329.  -29.   6.
'REC 55'       -404.  -29.   6.
'REC 56'       -479   -29.   6.
'15,000 AADT'     16  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'       0.   13.     1000.     13.  1080.   5.5    1. 32.
2
'ARTERIAL WB QUEUE'    'AG'       41.  13.     1000.     13.  1. 12. 1
    100 50 2. 1080 52.6  1800 1 3
1
'ARTERIAL WB DEP'      'AG'       0.   13.    -1000.     13.   1044.   5.5   1. 32.
```

```
2
'ARTERIAL WB L QUEUE'  'AG'       41.   0.     1000.     0.  1. 12. 1
    100 50 2. 108 52.6  1800 1 3
1

'ARTERIAL EB APPR.'    'AG'        0.  -13.   -1000.    -13.  720.   5.5    1. 32.
2
'ARTERIAL EB QUEUE'    'AG'      -41. -13.     -1000.    -13.  1. 12. 1
    100 50 2. 720 52.6  1800 1 3
1
'ARTERIAL EB DEP'      'AG'        0.  -13.    1000.    -13.   756.   5.5   1. 32.
2
'ARTERIAL EB L QUEUE'  'AG'      -41.   0.     -1000.      0.  1. 12. 1
    100 50 2. 72 52.6  1800 1 3
1
'ARTERIAL NB APPR.'    'AG'       13.   0.       13.     -1000.  1080.   5.5    1. 32.
2
'ARTERIAL NB QUEUE'    'AG'       13.   -41.     13.     -1000.  1. 12. 1
    100 50 2. 1080 52.6  1800 1 3
1
'ARTERIAL NB DEP'      'AG'       13.    0.    13.        1000.   1044.   5.5   1. 32.
2
'ARTERIAL NB L QUEUE'  'AG'        0.  -41.     0.       -1000.      1.   12.    1
    100 50 2. 108 52.6  1800 1 3
1
'ARTERIAL SB APPR.'    'AG'      -13.  0.    -13.        1000.   720.   5.5    1. 32.
2
'ARTERIAL SB QUEUE'    'AG'      -13. 41.    -13.       -1000.  1. 12. 1
    100 50 2. 720 52.6  1800 1 3
1
'ARTERIAL SB DEP'      'AG'      -13.  0.    -13.       -1000.   756.   5.5   1. 32.
2
'ARTERIAL SB L QUEUE'  'AG'        0.  41.      0.        1000.  1. 12. 1
    100 50 2. 72 52.6  1800 1 3
1.0 0.  5  1000. 14.  'Y' 10  0 36
```

CAL3QHC Screening Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

```
   CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

JOB: 1 LANE UtCo 15K fu                                   RUN: 15,000 AADT

DATE :  5/ 5/ 3
TIME : 12:20:15

   The MODE flag has been set to C for calculating CO averages.

 SITE & METEOROLOGICAL VARIABLES
 -------------------------------
 VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 108. CM
  U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 14.0 PPM

 LINK VARIABLES
 --------------
   LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                        *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT)  (FT)        (VEH)
------------------------*----------------------------------------*--------------------------------------------------------------
 1. ARTERIAL WB APPR.   *       .0      13.0    1000.0      13.0 *    1000.    90. AG   1080.   5.5   1.0 32.0
 2. ARTERIAL WB QUEUE   *     41.0      13.0    2999.4      13.0 *    2958.    90. AG     71. 100.0   1.0 12.0 1.30 150.3
 3. ARTERIAL WB DEP     *       .0      13.0   -1000.0      13.0 *    1000.   270. AG   1044.   5.5   1.0 32.0
 4. ARTERIAL WB L QUEUE *     41.0        .0      70.5        .0 *      30.    90. AG     71. 100.0   1.0 12.0  .13   1.5
 5. ARTERIAL EB APPR.   *       .0     -13.0   -1000.0     -13.0 *    1000.   270. AG    720.   5.5   1.0 32.0
 6. ARTERIAL EB QUEUE   *    -41.0     -13.0    -261.2     -13.0 *     220.   270. AG     71. 100.0   1.0 12.0  .87  11.2
 7. ARTERIAL EB DEP     *       .0     -13.0    1000.0     -13.0 *    1000.    90. AG    756.   5.5   1.0 32.0
 8. ARTERIAL EB L QUEUE *    -41.0        .0     -60.7        .0 *      20.   270. AG     71. 100.0   1.0 12.0  .09   1.0
 9. ARTERIAL NB APPR.   *     13.0        .0      13.0   -1000.0 *    1000.   180. AG   1080.   5.5   1.0 32.0
10. ARTERIAL NB QUEUE   *     13.0     -41.0      13.0   -2999.4 *    2958.   180. AG     71. 100.0   1.0 12.0 1.30 150.3
11. ARTERIAL NB DEP     *     13.0        .0      13.0    1000.0 *    1000.   360. AG   1044.   5.5   1.0 32.0
12. ARTERIAL NB L QUEUE *       .0     -41.0        .0     -70.5 *      30.   180. AG     71. 100.0   1.0 12.0  .13   1.5
13. ARTERIAL SB APPR.   *    -13.0        .0     -13.0    1000.0 *    1000.   360. AG    720.   5.5   1.0 32.0
14. ARTERIAL SB QUEUE   *    -13.0      41.0     -13.0    -179.2 *     220.   180. AG     71. 100.0   1.0 12.0  .87  11.2
15. ARTERIAL SB DEP     *    -13.0        .0     -13.0   -1000.0 *    1000.   180. AG    756.   5.5   1.0 32.0
16. ARTERIAL SB L QUEUE *       .0      41.0        .0      60.7 *      20.   360. AG     71. 100.0   1.0 12.0  .09   1.0
```

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

PAGE 2

JOB: 1 LANE UtCo 15K fu RUN: 15,000 AADT

DATE : 5/ 5/ 3
TIME : 12:20:15

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. ARTERIAL WB QUEUE	100	50	2.0	1080	1800	52.60	1	3
4. ARTERIAL WB L QUEUE	100	50	2.0	108	1800	52.60	1	3
6. ARTERIAL EB QUEUE	100	50	2.0	720	1800	52.60	1	3
8. ARTERIAL EB L QUEUE	100	50	2.0	72	1800	52.60	1	3
10. ARTERIAL NB QUEUE	100	50	2.0	1080	1800	52.60	1	3
12. ARTERIAL NB L QUEUE	100	50	2.0	108	1800	52.60	1	3
14. ARTERIAL SB QUEUE	100	50	2.0	720	1800	52.60	1	3
16. ARTERIAL SB L QUEUE	100	50	2.0	72	1800	52.60	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	29.0	29.0	6.0
2. REC 2	29.0	104.0	6.0
3. REC 3	29.0	179.0	6.0
4. REC 4	29.0	254.0	6.0
5. REC 5	29.0	329.0	6.0
6. REC 6	29.0	404.0	6.0
7. REC 7	29.0	479.0	6.0
8. REC 8	29.0	-29.0	6.0
9. REC 9	29.0	-104.0	6.0
10. REC 10	29.0	-174.0	6.0
11. REC 11	29.0	-254.0	6.0
12. REC 12	29.0	-329.0	6.0

13. REC 13	*	29.0	-404.0	6.0	*
14. REC 14	*	29.0	-479.0	6.0	*
15. REC 15	*	-29.0	29.0	6.0	*
16. REC 16	*	-29.0	104.0	6.0	*
17. REC 17	*	-29.0	179.0	6.0	*
18. REC 18	*	-29.0	254.0	6.0	*
19. REC 19	*	-29.0	329.0	6.0	*
20. REC 20	*	-29.0	404.0	6.0	*
21. REC 21	*	-29.0	479.0	6.0	*
22. REC 22	*	-29.0	-29.0	6.0	*
23. REC 23	*	-29.0	-104.0	6.0	*
24. REC 24	*	-29.0	-179.0	6.0	*
25. REC 25	*	-29.0	-254.0	6.0	*
26. REC 26	*	-29.0	-329.0	6.0	*
27. REC 27	*	-29.0	-404.0	6.0	*
28. REC 28	*	-29.0	-479.0	6.0	*
29. REC 30	*	104.0	29.0	6.0	*
30. REC 31	*	179.0	29.0	6.0	*
31. REC 32	*	254.0	29.0	6.0	*
32. REC 33	*	329.0	29.0	6.0	*
33. REC 34	*	404.0	29.0	6.0	*
34. REC 35	*	479.0	29.0	6.0	*
35. REC 37	*	-104.0	29.0	6.0	*
36. REC 38	*	-179.0	29.0	6.0	*
37. REC 39	*	-254.0	29.0	6.0	*

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

```
JOB: 1 LANE UtCo 15K fu                                   RUN: 15,000 AADT                                PAGE 3

      DATE :  5/ 5/ 3
      TIME : 12:20:15


       RECEPTOR LOCATIONS
       ------------------
                           *          COORDINATES (FT)          *
         RECEPTOR          *      X          Y          Z       *
     -------------------------*-------------------------------------*
     38. REC 40            *      -329.0       29.0        6.0   *
     39. REC 41            *      -404.0       29.0        6.0   *
     40. REC 42            *      -479.0       29.0        6.0   *
     41. REC 44            *       104.0      -29.0        6.0   *
     42. REC 45            *       179.0      -29.0        6.0   *
     43. REC 46            *       254.0      -29.0        6.0   *
     44. REC 47            *       329.0      -29.0        6.0   *
     45. REC 48            *       404.0      -29.0        6.0   *
     46. REC 49            *       479.0      -29.0        6.0   *
     47. REC 51            *      -104.0      -29.0        6.0   *
     48. REC 52            *      -179.0      -29.0        6.0   *
     49. REC 53            *      -254.0      -29.0        6.0   *
     50. REC 54            *      -329.0      -29.0        6.0   *
     51. REC 55            *      -404.0      -29.0        6.0   *
     52. REC 56            *      -479.0      -29.0        6.0   *
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CAL3QHC Screening – cont.
Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

JOB: 1 LANE UtCo 15K fu RUN: 15,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.7	14.8	14.7	14.8	15.0	14.9	14.9	14.4	14.4	14.4	14.4	14.4	14.4
10.	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.3	14.4	14.3	14.3	14.3	14.3	14.3	14.5	14.5	14.5	14.5	14.5	14.5
20.	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.4	14.3	14.2	14.2	14.1	14.1	14.1	14.5	14.5	14.5	14.5	14.5	14.5
30.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.4	14.3	14.2	14.1	14.0	14.0	14.0	14.4	14.4	14.4	14.4	14.4	14.4
40.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.6	14.3	14.2	14.2	14.0	14.0	14.0	14.6	14.4	14.4	14.4	14.4	14.4
50.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.6	14.3	14.3	14.2	14.0	14.0	14.0	14.5	14.3	14.3	14.3	14.3	14.3
60.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.7	14.3	14.3	14.2	14.1	14.0	14.0	14.4	14.2	14.2	14.2	14.2	14.2
70.	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.7	14.3	14.3	14.2	14.1	14.1	14.0	14.5	14.2	14.2	14.2	14.2	14.2
80.	14.3	14.0	14.0	14.0	14.0	14.0	14.0	14.8	14.3	14.1	14.1	14.1	14.0	14.0	14.6	14.2	14.2	14.2	14.2	14.2
90.	14.9	14.2	14.1	14.0	14.0	14.0	14.0	14.7	14.1	14.0	14.0	14.0	14.0	14.0	15.3	14.4	14.3	14.2	14.2	14.2
100.	15.1	14.4	14.2	14.1	14.1	14.0	14.0	14.1	14.0	14.0	14.0	14.0	14.0	14.0	15.4	14.6	14.4	14.3	14.3	14.2
110.	14.9	14.3	14.3	14.2	14.1	14.1	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.2	14.5	14.5	14.4	14.3	14.3
120.	14.8	14.3	14.3	14.2	14.2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.9	14.5	14.5	14.4	14.4	14.2
130.	14.7	14.3	14.2	14.2	14.2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.9	14.6	14.5	14.5	14.5	14.3
140.	14.5	14.3	14.2	14.2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.8	14.7	14.6	14.6	14.4	14.4
150.	14.5	14.3	14.2	14.2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	14.7	14.5	14.5	14.4	14.4
160.	14.4	14.3	14.2	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	15.4	14.6	14.6	14.5	14.5	14.5
170.	14.5	14.5	14.4	14.3	14.3	14.2	14.2	14.3	14.3	14.3	14.3	14.3	14.3	14.3	15.4	15.0	14.8	14.8	14.7	14.7
180.	15.2	14.9	15.0	14.7	14.6	14.8	14.8	14.9	14.9	14.9	14.9	14.9	14.9	14.9	15.2	15.1	14.8	14.7	14.7	14.7
190.	15.4	15.0	14.9	14.9	14.8	14.8	14.7	15.2	15.1	15.1	15.1	15.1	15.1	15.0	14.5	14.5	14.2	14.1	14.1	14.1
200.	15.3	14.8	14.7	14.5	14.5	14.5	14.5	15.0	14.9	14.9	14.9	14.9	14.9	14.9	14.5	14.3	14.2	14.1	14.0	14.0
210.	14.9	14.8	14.5	14.5	14.4	14.4	14.4	15.0	14.8	14.7	14.7	14.7	14.7	14.7	14.5	14.3	14.2	14.1	14.0	14.0

220.	*	14.8	14.7	14.6	14.5	14.4	14.4	14.4	14.8	14.7	14.6	14.6	14.6	14.6	14.6	14.5	14.3	14.2	14.1	14.0	14.0
230.	*	14.8	14.6	14.4	14.4	14.4	14.3	14.3	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.6	14.3	14.1	14.1	14.1	14.0
240.	*	14.9	14.6	14.5	14.4	14.4	14.3	14.3	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.6	14.3	14.2	14.1	14.1	14.0
250.	*	15.0	14.5	14.5	14.4	14.3	14.3	14.3	14.5	14.6	14.5	14.5	14.5	14.5	14.5	14.7	14.2	14.2	14.1	14.0	14.0
260.	*	15.2	14.5	14.4	14.3	14.3	14.3	14.3	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.8	14.2	14.1	14.0	14.0	14.0
270.	*	15.0	14.4	14.3	14.3	14.3	14.3	14.3	15.1	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.1	14.0	14.0	14.0	14.0
280.	*	14.5	14.3	14.3	14.3	14.3	14.3	14.3	15.2	14.8	14.6	14.5	14.5	14.5	14.5	14.2	14.0	14.0	14.0	14.0	14.0
290.	*	14.4	14.3	14.3	14.3	14.3	14.3	14.3	15.0	14.9	14.8	14.6	14.5	14.5	14.5	14.1	14.0	14.0	14.0	14.0	14.0
300.	*	14.4	14.3	14.3	14.3	14.3	14.3	14.3	14.8	14.9	14.8	14.6	14.5	14.5	14.5	14.0	14.0	14.0	14.0	14.0	14.0
310.	*	14.4	14.3	14.3	14.3	14.3	14.3	14.3	14.6	14.9	14.9	14.6	14.5	14.5	14.5	14.0	14.0	14.0	14.0	14.0	14.0
320.	*	14.5	14.4	14.4	14.4	14.4	14.4	14.4	14.8	15.1	14.9	14.7	14.6	14.6	14.6	14.0	14.0	14.0	14.0	14.0	14.0
330.	*	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.8	15.1	15.0	14.8	14.7	14.7	14.7	14.0	14.0	14.0	14.0	14.0	14.0
340.	*	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.7	15.1	15.1	14.9	14.9	14.8	14.8	14.0	14.0	14.0	14.0	14.0	14.0
350.	*	14.7	14.7	14.7	14.7	14.6	14.6	14.6	14.9	14.9	15.1	15.1	15.2	15.2	15.0	14.1	14.1	14.1	14.1	14.1	14.1
360.	*	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.7	14.8	14.7	14.8	15.0	14.9	14.9	14.4	14.4	14.4	14.4	14.4	14.4
MAX	*	15.4	15.0	15.0	14.9	14.8	14.8	14.8	15.2	15.1	15.1	15.1	15.2	15.2	15.0	15.4	15.1	14.8	14.8	14.7	14.7
DEGR.	*	190	190	180	190	190	180	180	190	190	190	190	350	350	190	100	180	170	170	170	170

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

PAGE 5

JOB: 1 LANE UtCo 15K fu RUN: 15,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	14.4	14.8	14.8	14.6	14.6	14.8	14.8	14.7	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
10.	14.5	15.0	14.8	15.0	14.9	14.8	14.9	14.8	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.0	14.0	14.0	14.0	14.0
20.	14.5	14.9	14.9	15.1	14.8	14.7	14.7	14.7	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.2	14.1	14.0	14.0	14.0
30.	14.4	15.0	15.0	14.9	14.7	14.6	14.6	14.6	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.2	14.1	14.0	14.0	14.0
40.	14.4	14.7	15.1	14.9	14.7	14.5	14.5	14.5	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.2	14.1	14.0	14.0	14.0
50.	14.3	14.8	14.9	15.0	14.7	14.5	14.5	14.5	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.1	14.1	14.0	14.0	14.0
60.	14.2	15.0	14.8	14.8	14.5	14.5	14.3	14.3	14.0	14.0	14.0	14.0	14.0	14.0	14.2	14.1	14.0	14.0	14.0	14.0
70.	14.2	15.2	14.8	14.8	14.5	14.4	14.4	14.3	14.1	14.1	14.1	14.1	14.1	14.1	14.2	14.1	14.0	14.1	14.1	14.1
80.	14.2	15.2	14.8	14.5	14.4	14.4	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.5	14.4	14.3	14.3	14.2	14.2
90.	14.2	15.1	14.6	14.4	14.3	14.3	14.3	14.3	14.9	14.9	14.9	14.9	14.9	14.9	15.0	14.8	14.7	14.7	14.9	14.8
100.	14.2	14.5	14.5	14.4	14.3	14.3	14.3	14.3	15.1	15.1	15.1	15.1	15.1	15.0	14.9	15.0	14.9	14.9	14.9	14.8
110.	14.3	14.6	14.5	14.3	14.3	14.3	14.3	14.3	14.9	14.9	14.9	14.9	14.9	14.9	14.8	14.8	14.7	14.6	14.6	14.5
120.	14.2	14.6	14.5	14.3	14.3	14.3	14.3	14.3	14.7	14.7	14.7	14.7	14.7	14.7	14.9	14.7	14.7	14.5	14.4	14.4
130.	14.3	14.8	14.7	14.5	14.5	14.5	14.5	14.5	14.6	14.6	14.6	14.6	14.6	14.6	14.9	14.8	14.6	14.4	14.4	14.4
140.	14.4	14.8	14.8	14.6	14.6	14.6	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.5	14.8	14.7	14.6	14.3	14.3	14.3
150.	14.4	15.0	14.9	14.6	14.6	14.6	14.6	14.6	14.5	14.5	14.5	14.5	14.5	14.5	14.8	14.7	14.6	14.5	14.3	14.3
160.	14.5	15.0	14.9	14.7	14.7	14.7	14.7	14.7	14.5	14.5	14.5	14.5	14.5	14.5	14.7	14.7	14.6	14.4	14.4	14.3
170.	14.7	15.1	15.0	14.8	14.7	14.7	14.7	14.7	14.5	14.5	14.5	14.5	14.5	14.5	14.7	14.5	14.5	14.4	14.3	14.3
180.	14.7	14.8	14.7	14.6	14.6	14.6	14.6	14.6	14.7	14.6	14.5	14.5	14.5	14.5	14.5	14.4	14.4	14.3	14.3	14.3
190.	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.9	14.7	14.6	14.6	14.5	14.5	14.4	14.4	14.4	14.3	14.3	14.3
200.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.8	14.8	14.7	14.6	14.6	14.6	14.4	14.4	14.3	14.3	14.3	14.3
210.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.8	14.8	14.7	14.7	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3

220.	*	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.9	14.7	14.7	14.7	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3
230.	*	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	14.8	14.8	14.6	14.6	14.6	14.5	14.5	14.4	14.4	14.4	14.4
240.	*	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.0	14.9	14.8	14.7	14.7	14.7	14.6	14.5	14.4	14.4	14.4	14.4
250.	*	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	15.1	15.0	14.8	14.8	14.8	14.8	14.6	14.5	14.5	14.5	14.5	14.5
260.	*	14.0	14.2	14.0	14.0	14.0	14.0	14.0	14.0	15.0	15.1	15.0	15.1	15.0	15.0	14.8	14.7	14.7	14.6	14.6	14.6
270.	*	14.0	14.6	14.0	14.0	14.0	14.0	14.0	14.0	14.8	14.8	14.7	14.9	14.9	14.9	14.5	14.5	14.5	14.5	14.5	14.5
280.	*	14.0	14.8	14.2	14.0	14.0	14.0	14.0	14.0	14.4	14.3	14.3	14.3	14.3	14.3	14.2	14.2	14.2	14.2	14.2	14.2
290.	*	14.0	14.8	14.3	14.2	14.1	14.0	14.0	14.0	14.2	14.1	14.2	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
300.	*	14.0	14.7	14.3	14.2	14.1	14.0	14.0	14.0	14.2	14.1	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
310.	*	14.0	14.7	14.3	14.2	14.1	14.0	14.0	14.0	14.2	14.1	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
320.	*	14.0	14.5	14.3	14.2	14.1	14.0	14.0	14.0	14.2	14.1	14.1	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
330.	*	14.0	14.4	14.3	14.2	14.0	14.0	14.0	14.0	14.2	14.2	14.1	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
340.	*	14.0	14.3	14.3	14.2	14.0	14.0	14.0	14.0	14.2	14.2	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
350.	*	14.1	14.3	14.4	14.3	14.2	14.1	14.1	14.1	14.2	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
360.	*	14.4	14.8	14.8	14.6	14.6	14.8	14.8	14.7	14.1	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
MAX	*	14.7	15.2	15.1	15.1	14.9	14.8	14.9	14.8	15.1	15.1	15.1	15.1	15.1	15.0	15.0	15.0	14.9	14.9	14.9	14.8
DEGR.	*	170	70	40	20	10	0	10	10	100	100	100	100	100	100	90	100	100	100	90	90

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Utah County
15,000 ADT
Future Emission Rates

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                                                                                                PAGE  6
     JOB: 1 LANE UtCo 15K fu                                    RUN: 15,000 AADT

      MODEL RESULTS
      -------------

      REMARKS : In search of the angle corresponding to
                the maximum concentration, only the first
                angle, of the angles with same maximum
                concentrations, is indicated as maximum.

 WIND ANGLE RANGE:   0.-360.

 WIND  * CONCENTRATION
 ANGLE *      (PPM)
 (DEGR)* REC41 REC42 REC43 REC44 REC45 REC46 REC47 REC48 REC49 REC50 REC51 REC52
 ------*------------------------------------------------------------------------
   0.  *  14.4  14.3  14.3  14.3  14.3  14.3  14.4  14.4  14.4  14.2  14.2  14.2
  10.  *  14.3  14.3  14.3  14.3  14.3  14.3  14.6  14.4  14.4  14.2  14.2  14.2
  20.  *  14.3  14.3  14.3  14.3  14.3  14.3  14.6  14.6  14.5  14.2  14.2  14.2
  30.  *  14.3  14.3  14.3  14.3  14.3  14.3  14.6  14.6  14.5  14.2  14.2  14.2
  40.  *  14.5  14.5  14.5  14.5  14.5  14.5  14.7  14.7  14.6  14.3  14.3  14.3
  50.  *  14.6  14.6  14.6  14.6  14.6  14.6  14.8  14.7  14.7  14.4  14.4  14.4
  60.  *  14.6  14.6  14.6  14.6  14.6  14.6  15.0  14.8  14.7  14.4  14.4  14.4
  70.  *  14.7  14.7  14.7  14.7  14.7  14.7  14.9  14.9  14.8  14.6  14.5  14.5
  80.  *  14.8  14.8  14.7  14.7  14.7  14.7  15.0  15.1  15.0  14.9  14.8  14.8
  90.  *  14.6  14.6  14.6  14.6  14.6  14.6  15.2  14.8  14.8  14.8  14.8  14.8
 100.  *  14.1  14.1  14.1  14.1  14.1  14.1  14.5  14.3  14.2  14.2  14.1  14.1
 110.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.4  14.3  14.1  14.0  14.0  14.0
 120.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.4  14.3  14.1  14.0  14.0  14.0
 130.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.4  14.2  14.1  14.0  14.0  14.0
 140.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.4  14.3  14.2  14.0  14.0  14.0
 150.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.3  14.3  14.2  14.1  14.0  14.0
 160.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.3  14.3  14.2  14.1  14.1  14.0
 170.  *  14.0  14.0  14.0  14.0  14.0  14.0  14.3  14.1  14.1  14.1  14.0  14.0
 180.  *  14.2  14.1  14.0  14.0  14.0  14.0  14.1  14.0  14.0  14.0  14.0  14.0
 190.  *  14.4  14.2  14.1  14.1  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
 200.  *  14.3  14.3  14.2  14.1  14.1  14.1  14.0  14.0  14.0  14.0  14.0  14.0
 210.  *  14.3  14.3  14.2  14.2  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
```

```
220.  *  14.3  14.2  14.2  14.2  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
230.  *  14.4  14.2  14.2  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
240.  *  14.4  14.2  14.2  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
250.  *  14.4  14.3  14.1  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0  14.0
260.  *  14.5  14.3  14.1  14.1  14.1  14.1  14.1  14.1  14.1  14.1  14.1  14.1
270.  *  14.8  14.7  14.5  14.7  14.7  14.7  14.6  14.5  14.4  14.4  14.4  14.4
280.  *  14.8  14.8  14.7  14.7  14.8  14.8  14.8  14.7  14.5  14.5  14.5  14.5
290.  *  14.6  14.8  14.7  14.7  14.7  14.7  14.8  14.8  14.5  14.5  14.5  14.5
300.  *  14.7  14.6  14.7  14.6  14.6  14.6  14.7  14.7  14.4  14.4  14.4  14.4
310.  *  14.8  14.6  14.6  14.5  14.5  14.5  14.6  14.6  14.4  14.4  14.4  14.4
320.  *  14.6  14.6  14.6  14.6  14.5  14.5  14.5  14.5  14.3  14.3  14.3  14.3
330.  *  14.5  14.5  14.4  14.4  14.3  14.3  14.4  14.4  14.3  14.2  14.2  14.2
340.  *  14.5  14.5  14.4  14.3  14.3  14.3  14.4  14.4  14.3  14.2  14.2  14.2
350.  *  14.5  14.4  14.3  14.3  14.3  14.3  14.4  14.4  14.4  14.2  14.2  14.2
360.  *  14.4  14.3  14.3  14.3  14.3  14.3  14.4  14.4  14.4  14.2  14.2  14.2
------*------------------------------------------------------------------------
MAX   *  14.8  14.8  14.7  14.7  14.8  14.8  15.2  15.1  15.0  14.9  14.8  14.8
DEGR. *   80    80    70    70   280   280    90    80    80    80    80    80

THE HIGHEST CONCENTRATION OF   15.40 PPM OCCURRED AT RECEPTOR REC15.
```

CAL3QHC Screening
Input

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

```
'2 LANE SLCo 25K Ex' 60. 108.  0.  0.  52   0.3048 1 1
'REC 1'        41.    41.    6.
'REC 2'        41.    116.   6.
'REC 3'        41.    191.   6.
'REC 4'        41.    266.   6.
'REC 5'        41.    341.   6.
'REC 6'        41.    416.   6.
'REC 7'        41.    491.   6.
'REC 8'        41.    -41.   6.
'REC 9'        41.    -116.  6.
'REC 10'       41.    -191.  6.
'REC 11'       41.    -266.  6.
'REC 12'       41.    -341.  6.
'REC 13'       41.    -416.  6.
'REC 14'       41.    -491.  6.
'REC 15'       -41.   41.    6.
'REC 16'       -41.   116.   6.
'REC 17'       -41.   191.   6.
'REC 18'       -41.   266.   6.
'REC 19'       -41.   341.   6.
'REC 20'       -41.   416.   6.
'REC 21'       -41.   491.   6.
'REC 22'       -41.   -41.   6.
'REC 23'       -41.   -116.  6.
'REC 24'       -41.   -191.  6.
'REC 25'       -41.   -255.  6.
'REC 26'       -41.   -341.  6.
'REC 27'        -41.  -416.  6.
'REC 28'       -41.   -491.  6.
'REC 29'       116.   41.    6.
'REC 30'       191.   41.    6.
'REC 31'       266.   41.    6.
'REC 32'       341.   41.    6.
'REC 33'       416.   41.    6.
'REC 34'       496.   41.    6.
'REC 35'       -116.  41.    6.
'REC 36'       -191.  41.    6.
'REC 37'       -266.  41.    6.
'REC 38'       -341.  41.    6.
'REC 39'       -416.  41.    6.
'REC 40'       -496.  41.    6.
'REC 41'       116.   -41.   6.
'REC 42'       191.   -41.   6.
'REC 43'       266.   -41.   6.
'REC 44'       341.   -41.   6.
'REC 45'       416.   -41.   6.
'REC 46'       491.   -41.   6.
'REC 47'       -116.  -41.   6.
'REC 48'       -191.  -41.   6.
'REC 49'       -266.  -41.   6.
'REC 50'       -341.  -41.   6.
'REC 51'       -416.  -41.   6.
'REC 52'       -491.  -41.   6.
'25,000 AADT'     16  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'       0.   19.     1000.     19.  1800.   12.3    1. 44.
2
'ARTERIAL WB QUEUE'    'AG'       53.  19.     1000.     19.  1. 12. 1
    65 33 2. 1800 126.7  1800 1 3
1
'ARTERIAL WB DEP'      'AG'       0.   19.    -1000.     19.   1740.   12.3   1. 44.
2
'ARTERIAL WB L QUEUE'  'AG'       53.   0.     1000.     0.  1. 12. 1
```

```
    65 33 2. 180 126.7  1800 1 3
1
'ARTERIAL EB APPR.'    'AG'        0.  -19.   -1000.    -19.  1200.   12.3    1. 44.
2
'ARTERIAL EB QUEUE'    'AG'      -53. -19.     -1000.    -19.  1. 12. 1
    65 33 2. 1200 126.7  1800 1 3
1
'ARTERIAL EB DEP'      'AG'        0.  -19.    1000.    -19.   1260.   12.3   1. 44.
2
'ARTERIAL EB L QUEUE'  'AG'      -53.   0.     -1000.      0.  1. 12. 1
    65 33 2. 120 126.7  1800 1 3
1
'ARTERIAL NB APPR.'    'AG'       19.   0.       19.     -1000.  1800.   12.3    1. 44.
2
'ARTERIAL NB QUEUE'    'AG'       19.   -53.     19.     -1000.  1. 12. 1
    65 33 2. 1800 126.7  1800 1 3
1
'ARTERIAL NB DEP'      'AG'       19.    0.    19.        1000.   1740.   12.3   1. 44.
2
'ARTERIAL NB L QUEUE'  'AG'        0.  -53.     0.       -1000.      1.   12.    1
    65 33 2. 180 126.7  1800 1 3
1
'ARTERIAL SB APPR.'    'AG'      -19.  0.    -19.        1000.   1200.   12.3    1. 44.
2
'ARTERIAL SB QUEUE'    'AG'      -19. 53.    -19.       -1000.  1. 12. 1
    65 33 2. 1200 126.7  1800 1 3
1
'ARTERIAL SB DEP'      'AG'      -19.  0.    -19.       -1000.   1260.   12.3   1. 44.
2
'ARTERIAL SB L QUEUE'  'AG'        0.  53.      0.        1000.  1. 12. 1
    65 33 2. 120 126.7  1800 1 3
1.0 0.  5  1000. 12.  'Y' 10  0 36
```

CAL3QHC Screening Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

```
                 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

  JOB: 2 LANE SLCo 25K Ex                                    RUN: 25,000 AADT

  DATE :  5/ 5/ 3
  TIME : 16: 7:10

     The MODE flag has been set to C for calculating CO averages.

   SITE & METEOROLOGICAL VARIABLES
   -------------------------------
   VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 108. CM
    U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 12.0 PPM

   LINK VARIABLES
   --------------
     LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                          *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT)  (FT)        (VEH)
  ------------------------*----------------------------------------*---------------------------------------------------------------
   1. ARTERIAL WB APPR.   *       .0      19.0    1000.0      19.0 *    1000.    90. AG   1800.  12.3   1.0 44.0
   2. ARTERIAL WB QUEUE   *     53.0      19.0   10782.5      19.0 *    *****    90. AG    173. 100.0   1.0 12.0 2.32 545.1
   3. ARTERIAL WB DEP     *       .0      19.0   -1000.0      19.0 *    1000.   270. AG   1740.  12.3   1.0 44.0
   4. ARTERIAL WB L QUEUE *     53.0        .0      85.5        .0 *      32.    90. AG    173. 100.0   1.0 12.0  .23   1.6
   5. ARTERIAL EB APPR.   *       .0     -19.0   -1000.0     -19.0 *    1000.   270. AG   1200.  12.3   1.0 44.0
   6. ARTERIAL EB QUEUE   *    -53.0     -19.0   -4663.3     -19.0 *    4610.   270. AG    173. 100.0   1.0 12.0 1.55 234.2
   7. ARTERIAL EB DEP     *       .0     -19.0    1000.0     -19.0 *    1000.    90. AG   1260.  12.3   1.0 44.0
   8. ARTERIAL EB L QUEUE *    -53.0        .0     -74.7        .0 *      22.   270. AG    173. 100.0   1.0 12.0  .15   1.1
   9. ARTERIAL NB APPR.   *     19.0        .0      19.0   -1000.0 *    1000.   180. AG   1800.  12.3   1.0 44.0
  10. ARTERIAL NB QUEUE   *     19.0     -53.0      19.0  -10782.5 *    *****   180. AG    173. 100.0   1.0 12.0 2.32 545.1
  11. ARTERIAL NB DEP     *     19.0        .0      19.0    1000.0 *    1000.   360. AG   1740.  12.3   1.0 44.0
  12. ARTERIAL NB L QUEUE *       .0     -53.0        .0     -85.5 *      32.   180. AG    173. 100.0   1.0 12.0  .23   1.6
  13. ARTERIAL SB APPR.   *    -19.0        .0     -19.0    1000.0 *    1000.   360. AG   1200.  12.3   1.0 44.0
  14. ARTERIAL SB QUEUE   *    -19.0      53.0     -19.0   -4557.3 *    4610.   180. AG    173. 100.0   1.0 12.0 1.55 234.2
  15. ARTERIAL SB DEP     *    -19.0        .0     -19.0   -1000.0 *    1000.   180. AG   1260.  12.3   1.0 44.0
  16. ARTERIAL SB L QUEUE *       .0      53.0        .0      74.7 *      22.   360. AG    173. 100.0   1.0 12.0  .15   1.1
```

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

JOB: 2 LANE SLCo 25K Ex   RUN: 25,000 AADT

DATE : 5/ 5/ 3
TIME : 16: 7:10

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. ARTERIAL WB QUEUE	65	33	2.0	1800	1800	126.70	1	3
4. ARTERIAL WB L QUEUE	65	33	2.0	180	1800	126.70	1	3
6. ARTERIAL EB QUEUE	65	33	2.0	1200	1800	126.70	1	3
8. ARTERIAL EB L QUEUE	65	33	2.0	120	1800	126.70	1	3
10. ARTERIAL NB QUEUE	65	33	2.0	1800	1800	126.70	1	3
12. ARTERIAL NB L QUEUE	65	33	2.0	180	1800	126.70	1	3
14. ARTERIAL SB QUEUE	65	33	2.0	1200	1800	126.70	1	3
16. ARTERIAL SB L QUEUE	65	33	2.0	120	1800	126.70	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	41.0	41.0	6.0
2. REC 2	41.0	116.0	6.0
3. REC 3	41.0	191.0	6.0
4. REC 4	41.0	266.0	6.0
5. REC 5	41.0	341.0	6.0
6. REC 6	41.0	416.0	6.0
7. REC 7	41.0	491.0	6.0
8. REC 8	41.0	-41.0	6.0
9. REC 9	41.0	-116.0	6.0
10. REC 10	41.0	-191.0	6.0
11. REC 11	41.0	-266.0	6.0
12. REC 12	41.0	-341.0	6.0
13. REC 13	41.0	-416.0	6.0
14. REC 14	41.0	-491.0	6.0
15. REC 15	-41.0	41.0	6.0

```
16. REC 16               *      -41.0     116.0        6.0   *
17. REC 17               *      -41.0     191.0        6.0   *
18. REC 18               *      -41.0     266.0        6.0   *
19. REC 19               *      -41.0     341.0        6.0   *
20. REC 20               *      -41.0     416.0        6.0   *
21. REC 21               *      -41.0     491.0        6.0   *
22. REC 22               *      -41.0     -41.0        6.0   *
23. REC 23               *      -41.0    -116.0        6.0   *
24. REC 24               *      -41.0    -191.0        6.0   *
25. REC 25               *      -41.0    -255.0        6.0   *
26. REC 26               *      -41.0    -341.0        6.0   *
27. REC 27               *      -41.0    -416.0        6.0   *
28. REC 28               *      -41.0    -491.0        6.0   *
29. REC 29               *      116.0      41.0        6.0   *
30. REC 30               *      191.0      41.0        6.0   *
31. REC 31               *      266.0      41.0        6.0   *
32. REC 32               *      341.0      41.0        6.0   *
33. REC 33               *      416.0      41.0        6.0   *
34. REC 34               *      496.0      41.0        6.0   *
35. REC 35               *     -116.0      41.0        6.0   *
36. REC 36               *     -191.0      41.0        6.0   *
37. REC 37               *     -266.0      41.0        6.0   *
```

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

```
                                                                                                PAGE  3
JOB: 2 LANE SLCo 25K Ex                                    RUN: 25,000 AADT

DATE :  5/ 5/ 3
TIME : 16: 7:10


 RECEPTOR LOCATIONS
 ------------------
                         *           COORDINATES (FT)          *
   RECEPTOR              *      X           Y           Z      *
-------------------------*-------------------------------------*
38. REC 38               *      -341.0        41.0        6.0   *
39. REC 39               *      -416.0        41.0        6.0   *
40. REC 40               *      -496.0        41.0        6.0   *
41. REC 41               *       116.0       -41.0        6.0   *
42. REC 42               *       191.0       -41.0        6.0   *
43. REC 43               *       266.0       -41.0        6.0   *
44. REC 44               *       341.0       -41.0        6.0   *
45. REC 45               *       416.0       -41.0        6.0   *
46. REC 46               *       491.0       -41.0        6.0   *
47. REC 47               *      -116.0       -41.0        6.0   *
48. REC 48               *      -191.0       -41.0        6.0   *
49. REC 49               *      -266.0       -41.0        6.0   *
50. REC 50               *      -341.0       -41.0        6.0   *
51. REC 51               *      -416.0       -41.0        6.0   *
52. REC 52               *      -491.0       -41.0        6.0   *
```

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

JOB: 2 LANE SLCo 25K Ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	13.7	13.7	13.6	13.5	13.5	13.5	13.4	14.8	14.4	14.4	14.5	14.5	14.5	14.8	13.4	13.4	13.3	13.2	13.2	13.2
10.	12.7	12.6	12.6	12.5	12.5	12.5	12.5	13.9	13.5	13.2	13.2	13.2	13.0	13.0	13.8	13.8	13.8	13.8	13.7	13.7
20.	12.2	12.2	12.2	12.2	12.2	12.2	12.2	13.6	12.8	12.6	12.6	12.6	12.5	12.5	13.6	13.6	13.6	13.6	13.6	13.6
30.	12.1	12.1	12.1	12.1	12.1	12.1	12.1	13.6	12.9	12.6	12.5	12.5	12.5	12.4	13.3	13.3	13.3	13.3	13.3	13.3
40.	12.2	12.1	12.1	12.1	12.1	12.1	12.1	13.7	12.9	12.6	12.6	12.5	12.5	12.4	13.3	13.1	13.1	13.1	13.1	13.1
50.	12.2	12.1	12.1	12.1	12.1	12.1	12.1	13.8	12.9	12.8	12.6	12.5	12.5	12.4	13.5	13.1	13.1	13.1	13.1	13.1
60.	12.1	12.0	12.0	12.0	12.0	12.0	12.0	13.8	12.9	12.7	12.5	12.4	12.3	12.3	13.5	13.0	13.0	13.0	13.0	13.0
70.	12.2	12.0	12.0	12.0	12.0	12.0	12.0	14.1	13.1	12.7	12.6	12.4	12.3	12.1	13.7	13.0	13.0	13.0	13.0	13.0
80.	13.0	12.1	12.0	12.0	12.0	12.0	12.0	14.4	12.9	12.6	12.4	12.2	12.2	12.2	14.3	13.0	12.9	12.9	12.9	12.9
90.	14.6	12.6	12.3	12.2	12.1	12.1	12.1	13.9	12.5	12.2	12.1	12.1	12.1	12.1	15.7	13.5	13.2	13.1	13.0	13.0
100.	15.1	13.1	12.6	12.3	12.2	12.2	12.2	12.6	12.0	12.0	12.0	12.0	12.0	12.0	16.2	14.0	13.5	13.3	13.1	13.1
110.	14.6	13.1	12.7	12.5	12.4	12.2	12.1	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.6	14.1	13.7	13.5	13.5	13.3
120.	14.2	13.1	12.7	12.7	12.4	12.4	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.0	14.0	13.7	13.7	13.4	13.4
130.	14.0	12.9	12.8	12.6	12.5	12.5	12.5	12.2	12.1	12.1	12.1	12.1	12.1	12.1	14.9	14.1	13.8	13.6	13.5	13.5
140.	13.9	12.9	12.8	12.5	12.5	12.5	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.0	14.1	13.7	13.5	13.5	13.5
150.	13.6	12.9	12.7	12.5	12.5	12.5	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.2	14.2	13.9	13.7	13.7	13.7
160.	13.5	13.0	12.6	12.6	12.6	12.6	12.5	12.2	12.2	12.2	12.2	12.2	12.2	12.2	15.9	14.7	14.3	14.3	14.1	14.0
170.	14.1	13.8	13.5	13.4	13.4	13.1	13.1	13.1	13.0	13.0	13.0	13.0	12.9	12.9	16.4	15.8	15.3	14.8	14.9	14.6
180.	15.8	15.4	15.0	15.1	14.8	14.7	14.7	15.0	14.9	14.9	14.8	14.8	14.7	14.7	15.7	15.3	14.7	14.7	14.5	14.4
190.	16.4	15.8	15.5	15.3	15.0	14.9	14.9	15.6	15.6	15.6	15.6	15.6	15.4	15.4	14.0	13.5	13.3	13.2	13.1	13.0
200.	15.6	14.9	14.7	14.4	14.4	14.2	14.1	15.0	15.0	15.0	15.0	15.0	15.0	14.9	13.6	12.8	12.5	12.5	12.5	12.5
210.	14.9	14.6	14.1	13.8	13.8	13.9	13.8	14.5	14.4	14.4	14.4	14.4	14.4	14.4	13.4	12.8	12.7	12.5	12.5	12.5
220.	14.7	14.2	13.9	13.7	13.7	13.7	13.6	14.2	14.1	14.1	14.1	14.1	14.1	14.1	13.6	12.8	12.6	12.4	12.4	12.4
230.	14.8	14.1	13.8	13.5	13.5	13.5	13.5	14.1	14.0	14.0	14.0	14.0	14.0	14.0	13.7	12.8	12.7	12.4	12.4	12.4

240.	*	15.1	14.0	13.7	13.6	13.4	13.4	13.3	13.9	13.7	13.7	13.7	13.7	13.7	13.7	13.8	13.0	12.7	12.5	12.4	12.4
250.	*	15.6	14.1	13.7	13.5	13.5	13.3	13.2	13.7	13.6	13.6	13.6	13.6	13.6	13.6	14.2	13.1	12.7	12.5	12.4	12.2
260.	*	15.9	14.0	13.5	13.4	13.2	13.1	13.1	14.0	13.6	13.6	13.6	13.6	13.6	13.6	14.7	13.0	12.5	12.3	12.2	12.1
270.	*	15.4	13.5	13.2	13.1	13.1	13.0	13.0	15.3	14.1	13.8	13.7	13.7	13.7	13.6	14.1	12.5	12.1	12.1	12.1	12.0
280.	*	14.0	13.0	13.0	13.0	13.0	13.0	13.0	15.6	14.6	14.3	14.0	13.8	13.7	13.7	12.8	12.0	12.0	12.0	12.0	12.0
290.	*	13.5	13.0	13.0	13.0	13.0	13.0	13.0	15.1	14.6	14.3	14.2	14.0	13.9	13.7	12.2	12.0	12.0	12.0	12.0	12.0
300.	*	13.3	13.0	13.0	13.0	13.0	13.0	13.0	14.9	14.8	14.4	14.3	14.1	14.0	14.0	12.1	12.0	12.0	12.0	12.0	12.0
310.	*	13.4	13.1	13.1	13.1	13.1	13.1	13.1	14.7	14.8	14.6	14.4	14.4	14.4	14.3	12.1	12.0	12.0	12.0	12.0	12.0
320.	*	13.5	13.3	13.3	13.3	13.3	13.3	13.3	14.6	14.9	14.6	14.5	14.5	14.4	14.4	12.1	12.0	12.0	12.0	12.0	12.0
330.	*	13.5	13.5	13.5	13.5	13.5	13.5	13.5	14.7	15.2	15.1	14.8	14.8	14.7	14.7	12.1	12.1	12.1	12.1	12.1	12.1
340.	*	13.8	13.8	13.8	13.8	13.8	13.8	13.8	15.0	15.0	15.1	15.2	15.3	15.2	15.2	12.1	12.1	12.1	12.1	12.1	12.1
350.	*	14.2	14.2	14.1	14.1	14.0	14.0	14.0	15.2	15.0	15.4	15.4	15.5	15.6	15.6	12.5	12.5	12.5	12.5	12.5	12.4
360.	*	13.7	13.7	13.6	13.5	13.5	13.5	13.4	14.8	14.4	14.4	14.5	14.5	14.5	14.8	13.4	13.4	13.3	13.2	13.2	13.2
MAX	*	16.4	15.8	15.5	15.3	15.0	14.9	14.9	15.6	15.6	15.6	15.6	15.6	15.6	15.6	16.4	15.8	15.3	14.8	14.9	14.6
DEGR.	*	190	190	190	190	190	190	190	190	190	190	190	190	350	350	170	170	170	170	170	170

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

JOB: 2 LANE SLCo 25K Ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	13.1	14.4	14.2	14.1	14.2	14.3	14.3	14.4	12.3	12.0	12.0	12.0	12.0	12.0	12.2	12.0	12.0	12.0	12.0	12.0
10.	13.7	15.0	15.0	15.0	15.0	15.1	15.1	15.2	12.0	12.0	12.0	12.0	12.0	12.0	12.6	12.2	12.2	12.0	12.0	12.0
20.	13.6	15.2	14.9	14.8	15.0	15.0	15.0	15.1	12.0	12.0	12.0	12.0	12.0	12.0	12.7	12.5	12.4	12.2	12.2	12.0
30.	13.3	15.0	14.8	14.8	14.7	14.7	14.7	14.6	12.0	12.0	12.0	12.0	12.0	12.0	12.7	12.5	12.4	12.3	12.2	12.2
40.	13.1	14.9	14.8	14.5	14.6	14.5	14.5	14.4	12.1	12.1	12.1	12.1	12.1	12.1	12.7	12.6	12.5	12.4	12.4	12.3
50.	13.1	15.0	14.9	14.6	14.4	14.3	14.3	14.2	12.1	12.1	12.1	12.1	12.1	12.1	12.7	12.5	12.4	12.4	12.3	12.3
60.	13.0	15.0	14.6	14.4	14.2	14.1	14.1	14.0	12.1	12.1	12.1	12.1	12.1	12.1	12.6	12.5	12.4	12.4	12.3	12.3
70.	13.0	15.6	14.7	14.3	14.2	14.0	13.9	13.7	12.2	12.2	12.2	12.2	12.2	12.2	12.6	12.5	12.5	12.5	12.4	12.4
80.	12.9	15.9	14.5	14.3	14.0	13.8	13.8	13.8	12.9	12.9	12.9	12.9	12.8	12.8	13.6	13.3	13.2	13.2	12.9	12.9
90.	13.0	15.3	14.1	13.8	13.8	13.7	13.7	13.7	14.5	14.5	14.4	14.4	14.3	14.3	15.0	14.8	14.7	14.6	14.6	14.5
100.	13.1	14.2	13.6	13.6	13.6	13.6	13.6	13.6	15.1	15.1	15.1	15.1	14.9	14.9	15.4	15.0	15.1	15.0	14.9	15.1
110.	13.2	14.0	13.6	13.6	13.6	13.6	13.6	13.6	14.6	14.6	14.6	14.6	14.6	14.5	14.7	14.5	14.6	14.7	14.5	14.6
120.	13.3	13.9	13.7	13.7	13.7	13.7	13.7	13.7	14.1	14.1	14.1	14.1	14.1	14.1	14.6	14.3	14.2	14.2	14.3	14.2
130.	13.5	14.1	13.9	13.9	13.9	13.9	13.9	13.9	13.8	13.8	13.8	13.8	13.8	13.8	14.5	14.3	14.2	14.1	14.1	14.0
140.	13.4	14.2	14.1	14.1	14.1	14.1	14.1	14.1	13.7	13.7	13.7	13.7	13.7	13.7	14.5	14.3	14.0	13.9	13.9	13.8
150.	13.6	14.4	14.3	14.3	14.3	14.3	14.3	14.3	13.4	13.4	13.4	13.4	13.4	13.4	14.4	14.2	14.0	13.8	13.8	13.7
160.	14.0	14.8	14.8	14.8	14.8	14.7	14.7	14.7	13.4	13.4	13.4	13.4	13.4	13.4	14.6	14.1	14.0	13.8	13.6	13.4
170.	14.5	15.3	15.3	15.3	15.3	15.3	15.1	15.1	13.5	13.4	13.4	13.4	13.4	13.4	14.5	14.2	13.8	13.6	13.5	13.5
180.	14.3	14.7	14.7	14.7	14.6	14.5	14.5	14.4	14.2	13.8	13.7	13.6	13.5	13.5	14.0	13.6	13.4	13.4	13.4	13.3
190.	13.0	12.8	12.8	12.8	12.8	12.8	12.7	12.7	14.8	14.2	14.0	13.8	13.7	13.7	13.2	13.2	13.2	13.2	13.2	13.2
200.	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	14.8	14.3	14.1	14.1	13.8	13.7	13.3	13.3	13.3	13.3	13.3	13.3
210.	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	14.8	14.3	14.2	13.9	13.9	13.8	13.3	13.3	13.3	13.3	13.3	13.3
220.	12.3	12.1	12.1	12.1	12.1	12.1	12.1	12.1	14.8	14.5	14.2	14.2	14.2	14.2	13.4	13.4	13.4	13.4	13.4	13.4
230.	12.3	12.0	12.0	12.0	12.0	12.0	12.0	12.0	15.0	14.5	14.3	14.3	14.3	14.2	13.6	13.6	13.6	13.6	13.6	13.6

240.	*	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.2	15.0	14.6	14.6	14.6	14.5	13.8	13.8	13.8	13.8	13.8	13.8
250.	*	12.1	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.1	15.1	15.1	15.1	15.0	14.9	14.2	14.2	14.2	14.2	14.2	14.2
260.	*	12.1	12.7	12.0	12.0	12.0	12.0	12.0	12.0	15.5	15.8	15.6	15.5	15.6	15.6	14.7	14.6	14.6	14.5	14.5	14.5
270.	*	12.0	14.2	12.5	12.2	12.1	12.1	12.1	12.0	14.8	14.8	14.8	14.8	14.7	15.0	14.1	14.0	13.9	13.9	13.9	13.8
280.	*	12.0	14.7	13.0	12.5	12.4	12.2	12.1	12.1	13.5	13.1	13.2	13.2	13.0	13.0	12.7	12.7	12.6	12.6	12.6	12.6
290.	*	12.0	14.3	13.0	12.7	12.6	12.4	12.3	12.1	12.6	12.4	12.5	12.5	12.5	12.4	12.2	12.2	12.2	12.2	12.2	12.2
300.	*	12.0	13.9	13.0	12.7	12.6	12.4	12.3	12.3	12.6	12.6	12.4	12.4	12.4	12.3	12.1	12.1	12.1	12.1	12.1	12.1
310.	*	12.0	13.7	12.8	12.7	12.5	12.4	12.4	12.3	12.7	12.6	12.4	12.4	12.4	12.3	12.1	12.1	12.1	12.1	12.1	12.1
320.	*	12.0	13.7	12.9	12.7	12.6	12.5	12.4	12.4	12.7	12.6	12.4	12.4	12.4	12.3	12.1	12.1	12.1	12.1	12.1	12.1
330.	*	12.1	13.5	12.8	12.6	12.5	12.5	12.4	12.4	12.8	12.5	12.4	12.3	12.3	12.2	12.0	12.0	12.0	12.0	12.0	12.0
340.	*	12.1	13.5	12.8	12.6	12.5	12.5	12.4	12.4	12.8	12.5	12.3	12.2	12.1	12.0	12.0	12.0	12.0	12.0	12.0	12.0
350.	*	12.3	13.5	13.3	13.2	13.0	13.0	12.9	13.0	12.7	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
360.	*	13.1	14.4	14.2	14.1	14.2	14.3	14.3	14.4	12.3	12.0	12.0	12.0	12.0	12.0	12.2	12.0	12.0	12.0	12.0	12.0
MAX	*	14.5	15.9	15.3	15.3	15.3	15.3	15.1	15.2	15.5	15.8	15.6	15.5	15.6	15.6	15.4	15.0	15.1	15.0	14.9	15.1
DEGR.	*	170	80	170	170	170	170	10	10	260	260	260	260	260	260	100	100	100	100	100	100

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Salt Lake County
25,000 ADT
Existing Emission Rates

JOB: 2 LANE SLCo 25K Ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42	REC43	REC44	REC45	REC46	REC47	REC48	REC49	REC50	REC51	REC52
0.	13.5	13.3	13.2	13.2	13.2	13.2	13.5	13.3	13.3	13.3	13.3	13.3
10.	13.2	13.2	13.2	13.2	13.2	13.2	13.9	13.7	13.5	13.3	13.3	13.3
20.	13.2	13.2	13.2	13.2	13.2	13.2	14.1	13.9	13.8	13.6	13.6	13.4
30.	13.3	13.3	13.3	13.3	13.3	13.3	14.1	13.9	13.8	13.7	13.6	13.6
40.	13.4	13.4	13.4	13.4	13.4	13.4	14.4	14.1	14.0	13.9	13.9	13.8
50.	13.6	13.6	13.6	13.6	13.6	13.6	14.4	14.0	13.9	13.9	13.8	13.8
60.	13.7	13.7	13.7	13.7	13.7	13.7	14.8	14.4	14.2	14.2	14.1	14.1
70.	14.1	14.1	14.1	14.0	14.0	14.0	14.9	14.8	14.8	14.7	14.5	14.6
80.	14.4	14.4	14.4	14.4	14.2	14.2	15.4	15.2	15.2	15.3	15.2	15.0
90.	13.9	13.9	13.8	13.7	13.7	13.6	14.8	14.5	14.6	14.6	14.5	14.6
100.	12.6	12.6	12.6	12.6	12.5	12.5	13.6	13.3	13.2	13.2	13.1	13.1
110.	12.1	12.1	12.1	12.1	12.1	12.1	13.0	12.7	12.6	12.6	12.5	12.5
120.	12.1	12.1	12.1	12.1	12.1	12.1	13.1	12.7	12.6	12.6	12.6	12.5
130.	12.1	12.1	12.1	12.1	12.1	12.1	13.0	12.7	12.6	12.5	12.5	12.4
140.	12.0	12.0	12.0	12.0	12.0	12.0	13.0	12.9	12.6	12.5	12.5	12.4
150.	12.0	12.0	12.0	12.0	12.0	12.0	13.2	12.9	12.7	12.5	12.4	12.4
160.	12.0	12.0	12.0	12.0	12.0	12.0	13.4	12.9	12.8	12.6	12.4	12.2
170.	12.1	12.0	12.0	12.0	12.0	12.0	13.3	12.9	12.6	12.4	12.3	12.3
180.	12.8	12.4	12.3	12.2	12.1	12.1	12.8	12.4	12.2	12.2	12.2	12.1
190.	13.4	12.8	12.5	12.4	12.3	12.3	12.0	12.0	12.0	12.0	12.0	12.0
200.	13.4	12.9	12.7	12.6	12.3	12.2	12.0	12.0	12.0	12.0	12.0	12.0
210.	13.3	12.9	12.8	12.5	12.5	12.4	12.0	12.0	12.0	12.0	12.0	12.0
220.	13.0	12.9	12.6	12.5	12.5	12.5	12.0	12.0	12.0	12.0	12.0	12.0
230.	13.1	12.9	12.6	12.6	12.6	12.5	12.0	12.0	12.0	12.0	12.0	12.0

240. *	13.1	12.8	12.6	12.6	12.6	12.5	12.1	12.1	12.1	12.1	12.1	12.1
250. *	13.2	12.7	12.6	12.6	12.6	12.5	12.1	12.1	12.1	12.1	12.1	12.1
260. *	13.7	13.4	13.1	13.1	13.0	13.1	12.7	12.7	12.7	12.7	12.6	12.5
270. *	14.7	14.3	14.3	14.4	14.2	14.3	14.2	14.1	14.0	14.0	14.0	13.9
280. *	15.2	14.9	14.7	14.7	14.7	14.6	14.7	14.7	14.7	14.6	14.6	14.6
290. *	14.6	14.5	14.4	14.2	14.2	14.3	14.3	14.3	14.3	14.3	14.3	14.3
300. *	14.1	14.1	14.0	14.0	14.0	13.9	13.9	13.9	13.9	13.9	13.9	13.9
310. *	14.1	14.0	13.9	13.9	13.9	13.8	13.6	13.6	13.6	13.6	13.6	13.6
320. *	14.1	13.9	13.7	13.7	13.7	13.7	13.6	13.6	13.6	13.6	13.6	13.6
330. *	14.1	13.8	13.8	13.6	13.6	13.5	13.4	13.4	13.4	13.4	13.4	13.4
340. *	14.0	13.7	13.5	13.5	13.4	13.3	13.4	13.4	13.4	13.4	13.4	13.4
350. *	13.9	13.5	13.4	13.2	13.2	13.2	13.3	13.3	13.3	13.3	13.3	13.3
360. *	13.5	13.3	13.2	13.2	13.2	13.2	13.5	13.3	13.3	13.3	13.3	13.3
MAX *	15.2	14.9	14.7	14.7	14.7	14.6	15.4	15.2	15.2	15.3	15.2	15.0
DEGR. *	280	280	280	280	280	280	80	80	80	80	80	80

THE HIGHEST CONCENTRATION OF 16.40 PPM OCCURRED AT RECEPTOR REC15.

CAL3QHC Screening Input

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

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'1 LANE WeCo 25K ex' 60. 108.  0.  0.  52   0.3048 1 1
'REC 1'        29.    29.    6.
'REC 2'        29.    104.   6.
'REC 3'        29.    179.   6.
'REC 4'        29.    254.   6.
'REC 5'        29.    329.   6.
'REC 6'        29.    404.   6.
'REC 7'        29.    479.   6.
'REC 8'        29.    -29.   6.
'REC 9'        29.    -104.  6.
'REC 10'       29.    -174.  6.
'REC 11'       29.    -254.  6.
'REC 12'       29.    -329.  6.
'REC 13'       29.    -404.  6.
'REC 14'       29.    -479.  6.
'REC 15'       -29.   29.    6.
'REC 16'       -29.   104.   6.
'REC 17'       -29.   179.   6.
'REC 18'       -29.   254.   6.
'REC 19'       -29.   329.   6.
'REC 20'       -29.   404.   6.
'REC 21'       -29.   479.   6.
'REC 22'       -29.   -29.   6.
'REC 23'       -29.   -104.  6.
'REC 24'       -29.   -179.  6.
'REC 25'       -29.   -254.  6.
'REC 26'       -29.   -329.  6.
'REC 27'        -29.  -404.  6.
'REC 28'       -29.   -479.  6.
'REC 30'       104.   29.    6.
'REC 31'       179.   29.    6.
'REC 32'       254.   29.    6.
'REC 33'       329.   29.    6.
'REC 34'       404.   29.    6.
'REC 35'       479.   29.    6.
'REC 37'       -104.  29.    6.
'REC 38'       -179.  29.    6.
'REC 39'       -254.  29.    6.
'REC 40'       -329.  29.    6.
'REC 41'       -404.  29.    6.
'REC 42'       -479.  29.    6.
'REC 44'       104.   -29.   6.
'REC 45'       179.   -29.   6.
'REC 46'       254.   -29.   6.
'REC 47'       329.   -29.   6.
'REC 48'       404.   -29.   6.
'REC 49'       479.   -29.   6.
'REC 51'       -104.  -29.   6.
'REC 52'       -179.  -29.   6.
'REC 53'       -254.  -29.   6.
'REC 54'       -329.  -29.   6.
'REC 55'       -404.  -29.   6.
'REC 56'       -479   -29.   6.
'25,000 AADT'     16  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'       0.   13.     1000.     13.  1800.   13.4    1. 32.
2
'ARTERIAL WB QUEUE'    'AG'       41.  13.     1000.     13.  1. 12. 1
    100 50 2. 1800 141.0  1800 1 3
1
'ARTERIAL WB DEP'      'AG'       0.   13.    -1000.     13.   1740.   13.4   1. 32.
2
'ARTERIAL WB L QUEUE'  'AG'       41.   0.     1000.     0.  1. 12. 1
    100 50 2. 180 141.0  1800 1 3
```

```
1
'ARTERIAL EB APPR.'    'AG'        0.  -13.   -1000.    -13.  1200.   13.4    1. 32.
2
'ARTERIAL EB QUEUE'    'AG'      -41. -13.     -1000.    -13.  1. 12. 1
    100 50 2. 1200 141.0  1800 1 3
1
'ARTERIAL EB DEP'      'AG'        0.  -13.    1000.    -13.   1260.   13.4   1. 32.
2
'ARTERIAL EB L QUEUE'  'AG'      -41.   0.     -1000.      0.  1. 12. 1
    100 50 2. 120 141.0  1800 1 3
1
'ARTERIAL NB APPR.'    'AG'       13.   0.       13.     -1000.  1800.   13.4    1. 32.
2
'ARTERIAL NB QUEUE'    'AG'       13.   -41.     13.     -1000.  1. 12. 1
    100 50 2. 1800 141.0  1800 1 3
1
'ARTERIAL NB DEP'      'AG'       13.    0.    13.        1000.   1740.   13.4   1. 32.
2
'ARTERIAL NB L QUEUE'  'AG'        0.  -41.     0.       -1000.      1.   12.    1
    100 50 2. 180 141.0  1800 1 3
1
'ARTERIAL SB APPR.'    'AG'       -13.  0.    -13.        1000.   1200.   13.4    1. 32.
2
'ARTERIAL SB QUEUE'    'AG'       -13. 41.    -13.       -1000.  1. 12. 1
    100 50 2. 1200 141.0  1800 1 3
1
'ARTERIAL SB DEP'      'AG'       -13.  0.    -13.       -1000.   1260.   13.4   1. 32.
2
'ARTERIAL SB L QUEUE'  'AG'        0.  41.      0.        1000.  1. 12. 1
    100 50 2. 120 141.0  1800 1 3
1.0 0.  5  1000. 12.  'Y' 10  0 36
```

CAL3QHC Screening Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

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            CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

     JOB: 1 LANE WeCo 25K ex                                    RUN: 25,000 AADT

     DATE :  5/ 5/ 3
     TIME : 14:23:30

        The MODE flag has been set to C for calculating CO averages.

      SITE & METEOROLOGICAL VARIABLES
      -------------------------------
      VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 108. CM
       U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB = 12.0 PPM

      LINK VARIABLES
      --------------
        LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                             *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT)  (FT)       (VEH)
     ------------------------*----------------------------------------*-------------------------------------------------------------
      1. ARTERIAL WB APPR.   *       .0      13.0    1000.0      13.0 *    1000.    90. AG   1800.  13.4   1.0 32.0
      2. ARTERIAL WB QUEUE   *     41.0      13.0   10404.8      13.0 *    *****    90. AG    189. 100.0   1.0 12.0 2.17 526.5
      3. ARTERIAL WB DEP     *       .0      13.0   -1000.0      13.0 *    1000.   270. AG   1740.  13.4   1.0 32.0
      4. ARTERIAL WB L QUEUE *     41.0        .0      90.2        .0 *      49.    90. AG    189. 100.0   1.0 12.0  .22   2.5
      5. ARTERIAL EB APPR.   *       .0     -13.0   -1000.0     -13.0 *    1000.   270. AG   1200.  13.4   1.0 32.0
      6. ARTERIAL EB QUEUE   *    -41.0     -13.0   -4233.7     -13.0 *    4193.   270. AG    189. 100.0   1.0 12.0 1.45 213.0
      7. ARTERIAL EB DEP     *       .0     -13.0    1000.0     -13.0 *    1000.    90. AG   1260.  13.4   1.0 32.0
      8. ARTERIAL EB L QUEUE *    -41.0        .0     -73.8        .0 *      33.   270. AG    189. 100.0   1.0 12.0  .14   1.7
      9. ARTERIAL NB APPR.   *     13.0        .0      13.0   -1000.0 *    1000.   180. AG   1800.  13.4   1.0 32.0
     10. ARTERIAL NB QUEUE   *     13.0     -41.0      13.0  -10404.8 *    *****   180. AG    189. 100.0   1.0 12.0 2.17 526.5
     11. ARTERIAL NB DEP     *     13.0        .0      13.0    1000.0 *    1000.   360. AG   1740.  13.4   1.0 32.0
     12. ARTERIAL NB L QUEUE *       .0     -41.0        .0     -90.2 *      49.   180. AG    189. 100.0   1.0 12.0  .22   2.5
     13. ARTERIAL SB APPR.   *    -13.0        .0     -13.0    1000.0 *    1000.   360. AG   1200.  13.4   1.0 32.0
     14. ARTERIAL SB QUEUE   *    -13.0      41.0     -13.0   -4151.7 *    4193.   180. AG    189. 100.0   1.0 12.0 1.45 213.0
     15. ARTERIAL SB DEP     *    -13.0        .0     -13.0   -1000.0 *    1000.   180. AG   1260.  13.4   1.0 32.0
     16. ARTERIAL SB L QUEUE *       .0      41.0        .0      73.8 *      33.   360. AG    189. 100.0   1.0 12.0  .14   1.7
```

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

JOB: 1 LANE WeCo 25K ex RUN: 25,000 AADT

DATE : 5/ 5/ 3
TIME : 14:23:30

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. ARTERIAL WB QUEUE	100	50	2.0	1800	1800	141.00	1	3
4. ARTERIAL WB L QUEUE	100	50	2.0	180	1800	141.00	1	3
6. ARTERIAL EB QUEUE	100	50	2.0	1200	1800	141.00	1	3
8. ARTERIAL EB L QUEUE	100	50	2.0	120	1800	141.00	1	3
10. ARTERIAL NB QUEUE	100	50	2.0	1800	1800	141.00	1	3
12. ARTERIAL NB L QUEUE	100	50	2.0	180	1800	141.00	1	3
14. ARTERIAL SB QUEUE	100	50	2.0	1200	1800	141.00	1	3
16. ARTERIAL SB L QUEUE	100	50	2.0	120	1800	141.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	29.0	29.0	6.0
2. REC 2	29.0	104.0	6.0
3. REC 3	29.0	179.0	6.0
4. REC 4	29.0	254.0	6.0
5. REC 5	29.0	329.0	6.0
6. REC 6	29.0	404.0	6.0
7. REC 7	29.0	479.0	6.0
8. REC 8	29.0	-29.0	6.0
9. REC 9	29.0	-104.0	6.0
10. REC 10	29.0	-174.0	6.0
11. REC 11	29.0	-254.0	6.0
12. REC 12	29.0	-329.0	6.0

```
13. REC 13             *     29.0    -404.0      6.0  *
14. REC 14             *     29.0    -479.0      6.0  *
15. REC 15             *    -29.0      29.0      6.0  *
16. REC 16             *    -29.0     104.0      6.0  *
17. REC 17             *    -29.0     179.0      6.0  *
18. REC 18             *    -29.0     254.0      6.0  *
19. REC 19             *    -29.0     329.0      6.0  *
20. REC 20             *    -29.0     404.0      6.0  *
21. REC 21             *    -29.0     479.0      6.0  *
22. REC 22             *    -29.0     -29.0      6.0  *
23. REC 23             *    -29.0    -104.0      6.0  *
24. REC 24             *    -29.0    -179.0      6.0  *
25. REC 25             *    -29.0    -254.0      6.0  *
26. REC 26             *    -29.0    -329.0      6.0  *
27. REC 27             *    -29.0    -404.0      6.0  *
28. REC 28             *    -29.0    -479.0      6.0  *
29. REC 30             *    104.0      29.0      6.0  *
30. REC 31             *    179.0      29.0      6.0  *
31. REC 32             *    254.0      29.0      6.0  *
32. REC 33             *    329.0      29.0      6.0  *
33. REC 34             *    404.0      29.0      6.0  *
34. REC 35             *    479.0      29.0      6.0  *
35. REC 37             *   -104.0      29.0      6.0  *
36. REC 38             *   -179.0      29.0      6.0  *
37. REC 39             *   -254.0      29.0      6.0  *
```

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

PAGE 3

JOB: 1 LANE WeCo 25K ex RUN: 25,000 AADT

DATE : 5/ 5/ 3
TIME : 14:23:30

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
38. REC 40	-329.0	29.0	6.0
39. REC 41	-404.0	29.0	6.0
40. REC 42	-479.0	29.0	6.0
41. REC 44	104.0	-29.0	6.0
42. REC 45	179.0	-29.0	6.0
43. REC 46	254.0	-29.0	6.0
44. REC 47	329.0	-29.0	6.0
45. REC 48	404.0	-29.0	6.0
46. REC 49	479.0	-29.0	6.0
47. REC 51	-104.0	-29.0	6.0
48. REC 52	-179.0	-29.0	6.0
49. REC 53	-254.0	-29.0	6.0
50. REC 54	-329.0	-29.0	6.0
51. REC 55	-404.0	-29.0	6.0
52. REC 56	-479.0	-29.0	6.0

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

JOB: 1 LANE WeCo 25K ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	14.1	14.1	14.1	14.1	13.9	13.9	13.9	15.4	15.0	15.5	15.2	15.3	15.4	15.6	13.8	13.8	13.8	13.7	13.6	13.6
10.	12.9	12.8	12.8	12.8	12.8	12.8	12.8	14.3	13.7	13.6	13.5	13.5	13.4	13.6	14.3	14.3	14.3	14.2	14.2	14.1
20.	12.2	12.2	12.2	12.2	12.2	12.2	12.2	13.8	13.3	12.8	12.7	12.6	12.5	12.5	14.1	14.0	14.0	14.0	14.0	14.0
30.	12.1	12.1	12.1	12.1	12.1	12.1	12.1	13.9	13.0	12.8	12.6	12.5	12.5	12.4	13.8	13.6	13.6	13.6	13.6	13.6
40.	12.2	12.1	12.1	12.1	12.1	12.1	12.1	14.2	12.9	12.8	12.6	12.5	12.5	12.5	13.9	13.4	13.4	13.4	13.4	13.4
50.	12.2	12.1	12.1	12.1	12.1	12.1	12.1	14.4	13.0	12.8	12.6	12.5	12.5	12.5	14.0	13.2	13.2	13.2	13.2	13.2
60.	12.1	12.0	12.0	12.0	12.0	12.0	12.0	14.5	13.0	12.7	12.6	12.5	12.4	12.3	14.0	13.2	13.2	13.2	13.2	13.2
70.	12.2	12.0	12.0	12.0	12.0	12.0	12.0	14.7	13.2	12.8	12.6	12.4	12.4	12.1	14.0	13.1	13.1	13.1	13.1	13.1
80.	13.3	12.1	12.0	12.0	12.0	12.0	12.0	15.2	13.2	12.7	12.4	12.2	12.2	12.2	14.8	13.1	13.0	13.0	13.0	13.0
90.	15.3	12.7	12.4	12.2	12.1	12.1	12.1	14.5	12.6	12.2	12.2	12.1	12.1	12.1	16.8	13.8	13.5	13.3	13.2	13.2
100.	16.1	13.3	12.6	12.5	12.2	12.2	12.2	12.8	12.1	12.0	12.0	12.0	12.0	12.0	17.2	14.3	13.7	13.5	13.3	13.2
110.	15.3	13.3	12.9	12.5	12.5	12.4	12.1	12.2	12.0	12.0	12.0	12.0	12.0	12.0	16.3	14.4	14.0	13.8	13.6	13.5
120.	14.8	13.1	12.7	12.7	12.5	12.4	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.8	14.3	13.9	13.9	13.7	13.6
130.	14.6	13.1	12.8	12.7	12.5	12.5	12.5	12.2	12.1	12.1	12.1	12.1	12.1	12.1	15.5	14.3	13.9	13.8	13.6	13.6
140.	14.2	12.9	12.8	12.5	12.5	12.5	12.5	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.6	14.3	14.1	13.8	13.8	13.8
150.	13.9	13.0	12.8	12.5	12.5	12.5	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.9	14.9	14.2	13.9	13.9	13.9
160.	13.7	13.3	12.9	12.6	12.6	12.6	12.5	12.2	12.2	12.2	12.2	12.2	12.2	12.2	16.8	15.4	14.7	14.4	14.3	14.4
170.	14.6	14.1	13.9	13.7	13.6	13.3	13.5	13.4	13.4	13.4	13.3	13.3	13.3	13.3	17.7	16.6	15.9	15.4	15.3	15.1
180.	17.1	16.3	15.8	15.5	15.4	15.3	15.2	15.9	15.9	15.9	15.8	15.7	15.6	15.5	16.8	16.1	15.5	15.3	15.2	15.0
190.	17.6	16.8	16.1	15.9	15.6	15.4	15.5	16.8	16.7	16.6	16.5	16.5	16.5	16.5	14.6	14.0	13.6	13.4	13.4	13.2
200.	16.5	15.8	14.9	14.7	14.6	14.4	14.4	15.8	15.6	15.6	15.6	15.6	15.6	15.6	13.8	12.9	12.6	12.5	12.5	12.5
210.	15.7	15.2	14.4	14.1	14.1	14.1	14.0	15.3	15.0	15.0	15.0	15.0	15.0	15.0	13.9	13.0	12.8	12.5	12.5	12.5
220.	15.3	14.6	14.3	14.0	14.0	14.0	14.0	14.9	14.7	14.7	14.7	14.7	14.7	14.7	14.1	12.9	12.8	12.5	12.5	12.5
230.	15.5	14.4	14.0	13.8	13.7	13.7	13.7	14.6	14.4	14.4	14.4	14.4	14.4	14.4	14.3	12.9	12.7	12.5	12.4	12.4

240.	*	15.6	14.3	13.9	13.9	13.6	13.6	13.5	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.4	13.1	12.7	12.7	12.4	12.4
250.	*	16.3	14.3	13.9	13.7	13.7	13.6	13.4	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.8	13.1	12.7	12.5	12.5	12.3
260.	*	17.0	14.4	13.8	13.6	13.5	13.3	13.3	14.5	14.1	14.0	14.0	14.0	14.0	14.0	15.4	13.2	12.6	12.4	12.2	12.1
270.	*	16.3	13.8	13.5	13.3	13.3	13.2	13.2	16.4	14.7	14.3	14.2	14.2	14.2	14.1	14.7	12.6	12.3	12.1	12.1	12.0
280.	*	14.5	13.2	13.2	13.2	13.2	13.2	13.2	16.7	15.2	14.7	14.4	14.2	14.2	14.1	13.0	12.0	12.0	12.0	12.0	12.0
290.	*	13.7	13.2	13.2	13.2	13.2	13.2	13.2	16.1	15.4	14.8	14.6	14.4	14.4	14.1	12.2	12.0	12.0	12.0	12.0	12.0
300.	*	13.6	13.2	13.2	13.2	13.2	13.2	13.2	15.3	15.5	14.9	14.8	14.7	14.6	14.5	12.1	12.0	12.0	12.0	12.0	12.0
310.	*	13.8	13.3	13.3	13.3	13.3	13.3	13.3	15.1	15.8	15.1	15.0	14.8	14.8	14.8	12.1	12.0	12.0	12.0	12.0	12.0
320.	*	14.0	13.6	13.6	13.6	13.6	13.6	13.6	15.2	15.7	15.4	15.2	15.1	15.1	15.0	12.2	12.1	12.1	12.1	12.1	12.1
330.	*	13.9	13.7	13.7	13.7	13.7	13.7	13.7	15.2	16.0	15.6	15.3	15.4	15.4	15.3	12.1	12.1	12.1	12.1	12.1	12.1
340.	*	14.3	14.2	14.2	14.2	14.2	14.1	14.1	15.6	15.9	16.1	15.9	16.1	15.9	15.9	12.2	12.2	12.2	12.2	12.1	12.1
350.	*	14.7	14.6	14.6	14.6	14.5	14.5	14.5	15.9	16.2	16.4	16.4	16.4	16.4	16.6	12.6	12.6	12.6	12.6	12.6	12.6
360.	*	14.1	14.1	14.1	14.1	13.9	13.9	13.9	15.4	15.0	15.5	15.2	15.3	15.4	15.6	13.8	13.8	13.8	13.7	13.6	13.6
MAX	*	17.6	16.8	16.1	15.9	15.6	15.4	15.5	16.8	16.7	16.6	16.5	16.5	16.5	16.6	17.7	16.6	15.9	15.4	15.3	15.1
DEGR.	*	190	190	190	190	190	190	190	190	190	190	190	190	190	350	170	170	170	170	170	170

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

JOB: 1 LANE WeCo 25K ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	13.5	15.2	14.9	14.8	15.0	15.0	15.1	15.1	12.3	12.1	12.0	12.0	12.0	12.0	12.2	12.0	12.0	12.0	12.0	12.0
10.	14.1	15.9	15.9	15.9	16.1	16.1	16.1	16.3	12.0	12.0	12.0	12.0	12.0	12.0	12.7	12.4	12.2	12.0	12.0	12.0
20.	13.9	15.9	15.6	15.8	15.7	15.8	15.7	15.7	12.0	12.0	12.0	12.0	12.0	12.0	12.9	12.5	12.4	12.2	12.2	12.0
30.	13.6	15.6	15.7	15.4	15.3	15.2	15.3	15.2	12.0	12.0	12.0	12.0	12.0	12.0	12.7	12.5	12.4	12.3	12.3	12.2
40.	13.4	15.3	15.7	15.3	15.1	15.0	15.0	15.0	12.1	12.1	12.1	12.1	12.1	12.1	12.8	12.6	12.5	12.4	12.4	12.3
50.	13.2	15.4	15.6	15.0	14.8	14.7	14.7	14.7	12.1	12.1	12.1	12.1	12.1	12.1	12.7	12.6	12.5	12.4	12.4	12.3
60.	13.2	15.8	15.4	14.8	14.8	14.6	14.5	14.4	12.1	12.1	12.1	12.1	12.1	12.1	12.8	12.5	12.4	12.4	12.4	12.3
70.	13.1	16.4	15.3	14.8	14.6	14.4	14.4	14.1	12.2	12.2	12.2	12.2	12.2	12.2	12.9	12.6	12.5	12.5	12.4	12.4
80.	13.0	17.0	15.3	14.7	14.4	14.2	14.2	14.2	13.3	13.3	13.2	13.2	13.2	13.2	13.9	13.6	13.4	13.4	13.1	13.3
90.	13.2	16.3	14.7	14.2	14.2	14.1	14.1	14.1	15.3	15.3	15.2	15.2	15.1	15.0	15.8	15.3	15.2	15.3	15.2	15.2
100.	13.2	14.7	14.1	14.0	14.0	14.0	14.0	14.0	16.0	15.9	15.8	15.8	15.8	15.8	16.3	15.8	16.0	15.7	15.6	15.9
110.	13.3	14.3	14.0	14.0	14.0	14.0	14.0	14.0	15.1	15.1	15.1	15.1	15.1	15.1	15.5	15.3	15.1	15.1	15.0	15.0
120.	13.5	14.5	14.1	14.1	14.1	14.1	14.1	14.1	14.5	14.5	14.5	14.5	14.5	14.5	15.2	14.9	14.7	14.6	14.7	14.6
130.	13.6	14.7	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	15.0	14.9	14.6	14.5	14.5	14.5
140.	13.8	15.0	14.6	14.6	14.6	14.6	14.6	14.6	14.0	14.0	14.0	14.0	14.0	14.0	15.0	14.6	14.4	14.2	14.2	14.2
150.	13.9	15.2	14.9	14.9	14.9	14.9	14.9	14.9	13.9	13.9	13.9	13.9	13.9	13.9	14.8	14.4	14.4	14.2	14.0	13.9
160.	14.2	15.6	15.4	15.4	15.4	15.4	15.4	15.4	13.7	13.7	13.7	13.7	13.7	13.7	15.1	14.6	14.3	14.1	14.1	13.7
170.	15.1	16.3	16.2	16.1	16.1	16.1	16.1	16.0	13.8	13.7	13.7	13.7	13.7	13.7	15.1	14.5	14.1	13.9	13.9	13.8
180.	15.0	15.5	15.4	15.4	15.3	15.3	15.3	15.1	14.8	14.4	14.1	14.0	13.9	13.9	14.5	13.9	13.8	13.7	13.7	13.6
190.	13.3	13.2	13.2	13.2	13.1	13.1	13.1	13.1	15.5	14.7	14.4	14.2	14.0	14.0	13.7	13.5	13.5	13.5	13.5	13.5
200.	12.4	12.2	12.2	12.2	12.2	12.2	12.2	12.2	15.4	14.8	14.6	14.4	14.3	14.0	13.5	13.5	13.5	13.5	13.5	13.5
210.	12.4	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.6	14.8	14.8	14.5	14.4	14.3	13.5	13.5	13.5	13.5	13.5	13.5
220.	12.5	12.1	12.1	12.1	12.1	12.1	12.1	12.1	15.6	14.9	14.7	14.5	14.5	14.5	13.7	13.7	13.7	13.7	13.7	13.7

230.	*	12.4	12.1	12.0	12.0	12.0	12.0	12.0	12.0	15.5	15.2	14.8	14.8	14.8	14.8	14.0	14.0	14.0	14.0	14.0	14.0
240.	*	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	16.0	15.5	15.0	15.0	15.0	14.9	14.2	14.2	14.2	14.2	14.2	14.2
250.	*	12.1	12.2	12.0	12.0	12.0	12.0	12.0	12.0	16.1	15.9	15.7	15.7	15.6	15.5	14.7	14.7	14.7	14.7	14.6	14.6
260.	*	12.1	13.0	12.1	12.0	12.0	12.0	12.0	12.0	16.7	16.6	16.3	16.5	16.2	16.4	15.3	15.3	15.3	15.2	15.2	15.2
270.	*	12.0	14.8	12.5	12.2	12.1	12.1	12.1	12.0	15.5	15.8	15.7	15.7	15.6	15.6	14.7	14.7	14.7	14.5	14.4	14.4
280.	*	12.0	15.4	13.1	12.7	12.4	12.2	12.2	12.1	13.8	13.6	13.4	13.5	13.4	13.5	12.9	12.9	12.9	12.9	12.9	12.9
290.	*	12.0	15.0	13.3	12.8	12.6	12.4	12.4	12.1	12.9	12.6	12.5	12.5	12.5	12.4	12.2	12.2	12.2	12.2	12.2	12.2
300.	*	12.0	14.4	13.0	12.7	12.6	12.5	12.4	12.3	12.8	12.6	12.4	12.4	12.4	12.3	12.1	12.1	12.1	12.1	12.1	12.1
310.	*	12.0	14.2	13.0	12.7	12.6	12.4	12.4	12.3	12.7	12.6	12.4	12.4	12.4	12.4	12.1	12.1	12.1	12.1	12.1	12.1
320.	*	12.1	14.0	12.9	12.8	12.6	12.5	12.5	12.4	12.8	12.6	12.5	12.4	12.4	12.4	12.1	12.1	12.1	12.1	12.1	12.1
330.	*	12.1	13.8	13.0	12.7	12.5	12.5	12.5	12.4	12.8	12.5	12.5	12.3	12.3	12.2	12.0	12.0	12.0	12.0	12.0	12.0
340.	*	12.1	13.6	12.9	12.6	12.5	12.5	12.5	12.5	12.8	12.5	12.3	12.3	12.1	12.0	12.0	12.0	12.0	12.0	12.0	12.0
350.	*	12.6	13.7	13.5	13.5	13.2	13.3	13.3	13.3	12.8	12.3	12.2	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
360.	*	13.5	15.2	14.9	14.8	15.0	15.0	15.1	15.1	12.3	12.1	12.0	12.0	12.0	12.0	12.2	12.0	12.0	12.0	12.0	12.0
MAX	*	15.1	17.0	16.2	16.1	16.1	16.1	16.1	16.3	16.7	16.6	16.3	16.5	16.2	16.4	16.3	15.8	16.0	15.7	15.6	15.9
DEGR.	*	170	80	170	170	10	10	10	10	260	260	260	260	260	260	100	100	100	100	100	100

CAL3QHC Screening – cont.
Output

One Lane Each Direction
Weber County
25,000 ADT
Existing Emission Rates

JOB: 1 LANE WeCo 25K ex RUN: 25,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42	REC43	REC44	REC45	REC46	REC47	REC48	REC49	REC50	REC51	REC52
0.	13.8	13.6	13.5	13.5	13.5	13.5	13.9	13.6	13.6	13.6	13.6	13.6
10.	13.5	13.5	13.5	13.5	13.5	13.5	14.2	13.9	13.7	13.5	13.5	13.5
20.	13.5	13.5	13.5	13.5	13.5	13.5	14.5	14.1	14.0	13.8	13.8	13.6
30.	13.5	13.5	13.5	13.5	13.5	13.5	14.5	14.3	14.2	14.1	14.1	14.0
40.	13.7	13.7	13.7	13.7	13.7	13.7	14.7	14.3	14.2	14.1	14.1	14.1
50.	13.9	13.9	13.9	13.9	13.9	13.9	14.9	14.6	14.5	14.4	14.4	14.3
60.	14.2	14.2	14.2	14.2	14.2	14.2	15.5	14.6	14.5	14.5	14.5	14.5
70.	14.5	14.5	14.5	14.5	14.5	14.5	15.8	15.3	15.1	15.1	15.1	15.0
80.	15.1	15.0	15.0	15.0	15.0	14.9	16.4	16.2	16.1	15.9	15.8	15.8
90.	14.4	14.4	14.3	14.3	14.3	14.1	15.5	15.5	15.3	15.3	15.3	15.4
100.	12.8	12.8	12.8	12.8	12.8	12.8	13.8	13.6	13.5	13.5	13.4	13.5
110.	12.2	12.2	12.2	12.2	12.2	12.2	13.3	12.9	12.7	12.6	12.5	12.5
120.	12.1	12.1	12.1	12.1	12.1	12.1	13.2	12.9	12.7	12.6	12.6	12.5
130.	12.1	12.1	12.1	12.1	12.1	12.1	13.1	13.0	12.7	12.6	12.6	12.6
140.	12.0	12.0	12.0	12.0	12.0	12.0	13.2	12.9	12.7	12.5	12.5	12.5
150.	12.0	12.0	12.0	12.0	12.0	12.0	13.3	12.9	12.8	12.7	12.5	12.4
160.	12.0	12.0	12.0	12.0	12.0	12.0	13.6	13.1	12.8	12.6	12.6	12.2
170.	12.1	12.0	12.0	12.0	12.0	12.0	13.6	13.0	12.6	12.4	12.4	12.3
180.	13.0	12.6	12.3	12.2	12.1	12.1	12.9	12.4	12.3	12.2	12.2	12.1
190.	13.7	12.9	12.7	12.4	12.3	12.3	12.2	12.0	12.0	12.0	12.0	12.0
200.	13.6	13.1	12.7	12.7	12.6	12.2	12.0	12.0	12.0	12.0	12.0	12.0
210.	13.4	12.9	12.9	12.6	12.5	12.4	12.0	12.0	12.0	12.0	12.0	12.0
220.	13.2	12.9	12.7	12.5	12.5	12.5	12.0	12.0	12.0	12.0	12.0	12.0

230.	*	13.1	13.0	12.6	12.6	12.6	12.6	12.1	12.1	12.1	12.1	12.1	12.1
240.	*	13.2	13.0	12.6	12.6	12.6	12.5	12.1	12.1	12.1	12.1	12.1	12.1
250.	*	13.3	12.9	12.6	12.6	12.7	12.6	12.2	12.2	12.2	12.1	12.1	12.1
260.	*	13.9	13.7	13.4	13.3	13.3	13.3	13.0	13.0	13.0	13.0	12.9	12.9
270.	*	15.4	14.9	15.0	14.8	14.9	14.8	14.8	14.8	14.7	14.6	14.6	14.5
280.	*	15.8	15.5	15.5	15.6	15.3	15.4	15.4	15.4	15.3	15.3	15.2	15.2
290.	*	15.2	14.9	14.7	14.8	14.7	14.7	14.9	14.9	14.9	14.9	14.9	14.8
300.	*	15.1	14.6	14.4	14.4	14.5	14.4	14.3	14.3	14.3	14.3	14.3	14.3
310.	*	14.8	14.4	14.2	14.2	14.2	14.2	14.1	14.1	14.1	14.1	14.1	14.1
320.	*	14.8	14.2	14.1	14.0	14.0	14.0	13.8	13.8	13.8	13.8	13.8	13.8
330.	*	14.6	14.0	14.0	13.8	13.8	13.7	13.8	13.8	13.8	13.8	13.8	13.8
340.	*	14.4	14.0	13.8	13.8	13.7	13.6	13.6	13.6	13.6	13.6	13.6	13.6
350.	*	14.4	13.8	13.7	13.6	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
360.	*	13.8	13.6	13.5	13.5	13.5	13.5	13.9	13.6	13.6	13.6	13.6	13.6
MAX	*	15.8	15.5	15.5	15.6	15.3	15.4	16.4	16.2	16.1	15.9	15.8	15.8
DEGR.	*	280	280	280	280	280	280	80	80	80	80	80	80

THE HIGHEST CONCENTRATION OF 17.70 PPM OCCURRED AT RECEPTOR REC15.

CAL3QHC Screening
Input

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

```
'2 LANE St.George 35K fu' 60. 108.  0.  0.  52   0.3048 1 1
'REC 1'        41.    41.    6.
'REC 2'        41.    116.   6.
'REC 3'        41.    191.   6.
'REC 4'        41.    266.   6.
'REC 5'        41.    341.   6.
'REC 6'        41.    416.   6.
'REC 7'        41.    491.   6.
'REC 8'        41.    -41.   6.
'REC 9'        41.    -116.  6.
'REC 10'       41.    -191.  6.
'REC 11'       41.    -266.  6.
'REC 12'       41.    -341.  6.
'REC 13'       41.    -416.  6.
'REC 14'       41.    -491.  6.
'REC 15'       -41.   41.    6.
'REC 16'       -41.   116.   6.
'REC 17'       -41.   191.   6.
'REC 18'       -41.   266.   6.
'REC 19'       -41.   341.   6.
'REC 20'       -41.   416.   6.
'REC 21'       -41.   491.   6.
'REC 22'       -41.   -41.   6.
'REC 23'       -41.   -116.  6.
'REC 24'       -41.   -191.  6.
'REC 25'       -41.   -255.  6.
'REC 26'       -41.   -341.  6.
'REC 27'        -41.  -416.  6.
'REC 28'       -41.   -491.  6.
'REC 29'       116.   41.    6.
'REC 30'       191.   41.    6.
'REC 31'       266.   41.    6.
'REC 32'       341.   41.    6.
'REC 33'       416.   41.    6.
'REC 34'       496.   41.    6.
'REC 35'       -116.  41.    6.
'REC 36'       -191.  41.    6.
'REC 37'       -266.  41.    6.
'REC 38'       -341.  41.    6.
'REC 39'       -416.  41.    6.
'REC 40'       -496.  41.    6.
'REC 41'       116.   -41.   6.
'REC 42'       191.   -41.   6.
'REC 43'       266.   -41.   6.
'REC 44'       341.   -41.   6.
'REC 45'       416.   -41.   6.
'REC 46'       491.   -41.   6.
'REC 47'       -116.  -41.   6.
'REC 48'       -191.  -41.   6.
'REC 49'       -266.  -41.   6.
'REC 50'       -341.  -41.   6.
'REC 51'       -416.  -41.   6.
'REC 52'       -491.  -41.   6.
'35,000 AADT'     16  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'       0.   19.     1000.     19.  2520.   7.3    1. 44.
2
'ARTERIAL WB QUEUE'    'AG'       53.  19.     1000.     19.  1. 12. 1
    130 68 2. 2520 74.6  1800 1 3
1
'ARTERIAL WB DEP'      'AG'       0.   19.    -1000.     19.   2436.   7.3   1. 44.
2
'ARTERIAL WB L QUEUE'  'AG'       53.   0.     1000.     0.  1. 12. 1
```

```
    130 68 2. 252 74.6  1800 1 3
1
'ARTERIAL EB APPR.'    'AG'        0.  -19.   -1000.    -19.  1680.   7.3    1. 44.
2
'ARTERIAL EB QUEUE'    'AG'      -53. -19.     -1000.    -19.  1. 12. 1
    130 68 2. 1680 74.6  1800 1 3
1
'ARTERIAL EB DEP'      'AG'        0.  -19.    1000.    -19.   1764.   7.3   1. 44.
2
'ARTERIAL EB L QUEUE'  'AG'      -53.   0.     -1000.      0.  1. 12. 1
    130 68 2. 168 74.6  1800 1 3
1
'ARTERIAL NB APPR.'    'AG'       19.   0.       19.     -1000.  2520.   7.3    1. 44.
2
'ARTERIAL NB QUEUE'    'AG'       19.   -53.     19.     -1000.  1. 12. 1
    130 68 2. 2520 74.6  1800 1 3
1
'ARTERIAL NB DEP'      'AG'       19.    0.    19.        1000.   2436.   7.3   1. 44.
2
'ARTERIAL NB L QUEUE'  'AG'        0.  -53.     0.       -1000.      1.   12.    1
    130 68 2. 252 74.6  1800 1 3
1
'ARTERIAL SB APPR.'    'AG'       -19.  0.    -19.        1000.   1680.   7.3    1. 44.
2
'ARTERIAL SB QUEUE'    'AG'       -19. 53.    -19.       -1000.  1. 12. 1
    130 68 2. 1680 74.6  1800 1 3
1
'ARTERIAL SB DEP'      'AG'       -19.  0.    -19.       -1000.   1764.   7.3   1. 44.
2
'ARTERIAL SB L QUEUE'  'AG'        0.  53.      0.        1000.  1. 12. 1
    130 68 2. 168 74.6  1800 1 3
1.0 0.  5  1000. 8.  'Y' 10  0 36
```

CAL3QHC Screening Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

```
             CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221                        PAGE  1

 JOB: 2 LANE St.George 35K fu                             RUN: 35,000 AADT

 DATE :  5/ 5/ 3
 TIME : 21:50: 5

    The MODE flag has been set to C for calculating CO averages.

  SITE & METEOROLOGICAL VARIABLES
  -------------------------------
  VS =    .0 CM/S       VD =    .0 CM/S       Z0 = 108. CM
   U =  1.0 M/S         CLAS =   5  (E)     ATIM =  60. MINUTES     MIXH =  1000. M   AMB =  8.0 PPM

  LINK VARIABLES
  --------------
    LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                         *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT) (FT)       (VEH)
 ------------------------*----------------------------------------*--------------------------------------------------------------
  1. ARTERIAL WB APPR.   *       .0      19.0    1000.0      19.0 *    1000.    90. AG   2520.   7.3   1.0 44.0
  2. ARTERIAL WB QUEUE   *     53.0      19.0   18321.4      19.0 *    *****    90. AG    105. 100.0   1.0 12.0 3.14 928.0
  3. ARTERIAL WB DEP     *       .0      19.0   -1000.0      19.0 *    1000.   270. AG   2436.   7.3   1.0 44.0
  4. ARTERIAL WB L QUEUE *     53.0        .0     146.7        .0 *      94.    90. AG    105. 100.0   1.0 12.0  .31   4.8
  5. ARTERIAL EB APPR.   *       .0     -19.0   -1000.0     -19.0 *    1000.   270. AG   1680.   7.3   1.0 44.0
  6. ARTERIAL EB QUEUE   *    -53.0     -19.0   -9597.4     -19.0 *    9544.   270. AG    105. 100.0   1.0 12.0 2.09 484.9
  7. ARTERIAL EB DEP     *       .0     -19.0    1000.0     -19.0 *    1000.    90. AG   1764.   7.3   1.0 44.0
  8. ARTERIAL EB L QUEUE *    -53.0        .0    -115.5        .0 *      62.   270. AG    105. 100.0   1.0 12.0  .21   3.2
  9. ARTERIAL NB APPR.   *     19.0        .0      19.0   -1000.0 *    1000.   180. AG   2520.   7.3   1.0 44.0
 10. ARTERIAL NB QUEUE   *     19.0     -53.0      19.0  -18321.4 *    *****   180. AG    105. 100.0   1.0 12.0 3.14 928.0
 11. ARTERIAL NB DEP     *     19.0        .0      19.0    1000.0 *    1000.   360. AG   2436.   7.3   1.0 44.0
 12. ARTERIAL NB L QUEUE *       .0     -53.0        .0    -146.7 *      94.   180. AG    105. 100.0   1.0 12.0  .31   4.8
 13. ARTERIAL SB APPR.   *    -19.0        .0     -19.0    1000.0 *    1000.   360. AG   1680.   7.3   1.0 44.0
 14. ARTERIAL SB QUEUE   *    -19.0      53.0     -19.0   -9491.4 *    9544.   180. AG    105. 100.0   1.0 12.0 2.09 484.9
 15. ARTERIAL SB DEP     *    -19.0        .0     -19.0   -1000.0 *    1000.   180. AG   1764.   7.3   1.0 44.0
 16. ARTERIAL SB L QUEUE *       .0      53.0        .0     115.5 *      62.   360. AG    105. 100.0   1.0 12.0  .21   3.2
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CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

JOB: 2 LANE St.George 35K fu RUN: 35,000 AADT

DATE : 5/ 5/ 3
TIME : 21:50: 5

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. ARTERIAL WB QUEUE	130	68	2.0	2520	1800	74.60	1	3
4. ARTERIAL WB L QUEUE	130	68	2.0	252	1800	74.60	1	3
6. ARTERIAL EB QUEUE	130	68	2.0	1680	1800	74.60	1	3
8. ARTERIAL EB L QUEUE	130	68	2.0	168	1800	74.60	1	3
10. ARTERIAL NB QUEUE	130	68	2.0	2520	1800	74.60	1	3
12. ARTERIAL NB L QUEUE	130	68	2.0	252	1800	74.60	1	3
14. ARTERIAL SB QUEUE	130	68	2.0	1680	1800	74.60	1	3
16. ARTERIAL SB L QUEUE	130	68	2.0	168	1800	74.60	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	41.0	41.0	6.0
2. REC 2	41.0	116.0	6.0
3. REC 3	41.0	191.0	6.0
4. REC 4	41.0	266.0	6.0
5. REC 5	41.0	341.0	6.0
6. REC 6	41.0	416.0	6.0
7. REC 7	41.0	491.0	6.0
8. REC 8	41.0	-41.0	6.0
9. REC 9	41.0	-116.0	6.0
10. REC 10	41.0	-191.0	6.0
11. REC 11	41.0	-266.0	6.0
12. REC 12	41.0	-341.0	6.0
13. REC 13	41.0	-416.0	6.0
14. REC 14	41.0	-491.0	6.0
15. REC 15	-41.0	41.0	6.0

16.	REC 16	*	-41.0	116.0	6.0	*
17.	REC 17	*	-41.0	191.0	6.0	*
18.	REC 18	*	-41.0	266.0	6.0	*
19.	REC 19	*	-41.0	341.0	6.0	*
20.	REC 20	*	-41.0	416.0	6.0	*
21.	REC 21	*	-41.0	491.0	6.0	*
22.	REC 22	*	-41.0	-41.0	6.0	*
23.	REC 23	*	-41.0	-116.0	6.0	*
24.	REC 24	*	-41.0	-191.0	6.0	*
25.	REC 25	*	-41.0	-255.0	6.0	*
26.	REC 26	*	-41.0	-341.0	6.0	*
27.	REC 27	*	-41.0	-416.0	6.0	*
28.	REC 28	*	-41.0	-491.0	6.0	*
29.	REC 29	*	116.0	41.0	6.0	*
30.	REC 30	*	191.0	41.0	6.0	*
31.	REC 31	*	266.0	41.0	6.0	*
32.	REC 32	*	341.0	41.0	6.0	*
33.	REC 33	*	416.0	41.0	6.0	*
34.	REC 34	*	496.0	41.0	6.0	*
35.	REC 35	*	-116.0	41.0	6.0	*
36.	REC 36	*	-191.0	41.0	6.0	*
37.	REC 37	*	-266.0	41.0	6.0	*

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

JOB: 2 LANE St.George 35K fu RUN: 35,000 AADT

DATE : 5/ 5/ 3
TIME : 21:50: 5

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
38. REC 38	-341.0	41.0	6.0
39. REC 39	-416.0	41.0	6.0
40. REC 40	-496.0	41.0	6.0
41. REC 41	116.0	-41.0	6.0
42. REC 42	191.0	-41.0	6.0
43. REC 43	266.0	-41.0	6.0
44. REC 44	341.0	-41.0	6.0
45. REC 45	416.0	-41.0	6.0
46. REC 46	491.0	-41.0	6.0
47. REC 47	-116.0	-41.0	6.0
48. REC 48	-191.0	-41.0	6.0
49. REC 49	-266.0	-41.0	6.0
50. REC 50	-341.0	-41.0	6.0
51. REC 51	-416.0	-41.0	6.0
52. REC 52	-491.0	-41.0	6.0

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

JOB: 2 LANE St.George 35K fu RUN: 35,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	9.4	9.4	9.3	9.3	9.3	9.3	9.1	10.2	9.8	9.9	10.0	10.0	10.2	10.0	9.1	9.1	9.1	9.1	9.1	8.9
10.	8.5	8.5	8.5	8.5	8.4	8.4	8.4	9.4	9.1	9.0	8.8	8.8	8.8	8.8	9.6	9.5	9.5	9.4	9.4	9.4
20.	8.1	8.1	8.1	8.1	8.1	8.1	8.1	9.2	8.7	8.6	8.5	8.4	8.4	8.3	9.5	9.4	9.4	9.4	9.4	9.3
30.	8.1	8.1	8.1	8.1	8.1	8.1	8.1	9.2	8.8	8.6	8.5	8.4	8.4	8.4	9.2	9.1	9.1	9.1	9.1	9.1
40.	8.2	8.1	8.1	8.1	8.1	8.1	8.1	9.4	8.8	8.6	8.5	8.4	8.4	8.4	9.1	8.9	8.9	8.9	8.9	8.9
50.	8.2	8.1	8.1	8.1	8.1	8.1	8.1	9.5	8.7	8.6	8.5	8.5	8.4	8.4	9.3	8.9	8.9	8.9	8.9	8.9
60.	8.1	8.0	8.0	8.0	8.0	8.0	8.0	9.5	8.7	8.5	8.4	8.4	8.3	8.3	9.2	8.8	8.8	8.8	8.8	8.8
70.	8.1	8.0	8.0	8.0	8.0	8.0	8.0	9.7	8.8	8.5	8.4	8.3	8.1	8.1	9.3	8.8	8.8	8.8	8.8	8.8
80.	8.7	8.0	8.0	8.0	8.0	8.0	8.0	9.9	8.8	8.4	8.3	8.1	8.1	8.1	9.7	8.8	8.8	8.8	8.8	8.8
90.	9.9	8.5	8.2	8.1	8.1	8.1	8.1	9.4	8.4	8.1	8.1	8.1	8.1	8.1	10.9	9.4	9.1	8.9	8.9	8.9
100.	10.3	8.8	8.5	8.2	8.1	8.1	8.1	8.5	8.0	8.0	8.0	8.0	8.0	8.0	11.4	9.7	9.3	9.0	8.9	8.9
110.	10.0	8.8	8.6	8.4	8.3	8.2	8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.0	10.9	9.8	9.4	9.2	9.1	9.0
120.	9.9	8.8	8.6	8.4	8.4	8.3	8.3	8.1	8.0	8.0	8.0	8.0	8.0	8.0	10.4	9.9	9.4	9.2	9.2	9.1
130.	9.6	8.8	8.6	8.5	8.5	8.4	8.4	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.3	9.8	9.4	9.3	9.3	9.2
140.	9.5	8.8	8.5	8.5	8.5	8.4	8.4	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.3	9.8	9.4	9.3	9.3	9.2
150.	9.3	8.8	8.5	8.5	8.4	8.4	8.4	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.7	9.8	9.6	9.5	9.4	9.4
160.	9.3	8.8	8.6	8.5	8.4	8.4	8.4	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.9	10.2	10.0	9.5	9.5	9.5
170.	9.7	9.3	9.2	9.1	8.9	8.9	8.9	8.8	8.8	8.8	8.8	8.8	8.7	8.7	11.3	10.8	10.7	10.5	10.4	10.0
180.	11.1	10.8	10.3	10.3	10.2	10.2	10.1	10.2	10.2	10.2	10.2	10.1	10.1	10.0	11.0	10.6	10.2	10.1	9.9	10.0
190.	11.5	10.8	10.8	10.7	10.4	10.4	10.2	10.6	10.6	10.6	10.6	10.6	10.6	10.4	9.9	9.5	9.0	9.0	8.9	8.9
200.	10.8	10.3	10.1	9.8	9.8	9.7	9.7	10.2	10.1	10.1	10.1	10.1	10.1	10.1	9.2	8.8	8.5	8.5	8.4	8.4
210.	10.4	10.0	9.8	9.6	9.5	9.5	9.4	10.1	9.9	9.9	9.9	9.9	9.9	9.9	9.2	8.7	8.4	8.4	8.3	8.3
220.	10.3	10.0	9.5	9.5	9.5	9.4	9.4	9.8	9.6	9.6	9.6	9.6	9.6	9.6	9.4	8.6	8.4	8.4	8.4	8.3

230.	*	10.4	10.0	9.4	9.4	9.4	9.3	9.3	9.6	9.6	9.5	9.5	9.5	9.5	9.5	9.5	8.6	8.4	8.4	8.4	8.3
240.	*	10.5	9.8	9.5	9.3	9.3	9.2	9.2	9.4	9.5	9.4	9.4	9.4	9.4	9.4	9.5	8.7	8.6	8.4	8.4	8.3
250.	*	10.7	9.8	9.5	9.3	9.2	9.1	9.0	9.3	9.5	9.3	9.3	9.3	9.3	9.3	9.8	8.8	8.6	8.4	8.3	8.2
260.	*	11.1	9.8	9.4	9.1	9.0	9.0	9.0	9.6	9.5	9.3	9.3	9.3	9.3	9.3	10.1	8.8	8.5	8.2	8.1	8.1
270.	*	10.7	9.5	9.0	9.0	9.0	9.0	8.9	10.5	9.8	9.3	9.3	9.3	9.3	9.2	9.7	8.5	8.1	8.1	8.1	8.1
280.	*	9.6	8.9	8.9	8.9	8.9	8.9	8.9	11.1	10.3	9.7	9.6	9.4	9.4	9.4	8.6	8.0	8.0	8.0	8.0	8.0
290.	*	9.2	8.9	8.9	8.9	8.9	8.9	8.9	10.4	10.3	9.8	9.7	9.6	9.6	9.4	8.1	8.0	8.0	8.0	8.0	8.0
300.	*	9.2	8.9	8.9	8.9	8.9	8.9	8.9	10.3	10.4	9.9	9.8	9.8	9.7	9.7	8.1	8.0	8.0	8.0	8.0	8.0
310.	*	9.3	9.0	9.0	9.0	9.0	9.0	9.0	10.2	10.4	10.1	9.9	9.9	9.8	9.8	8.1	8.0	8.0	8.0	8.0	8.0
320.	*	9.4	9.1	9.1	9.1	9.1	9.1	9.1	10.2	10.4	10.1	10.0	9.9	9.9	9.9	8.1	8.0	8.0	8.0	8.0	8.0
330.	*	9.3	9.2	9.2	9.2	9.2	9.2	9.2	10.2	10.2	10.3	10.1	10.2	10.2	10.2	8.0	8.0	8.0	8.0	8.0	8.0
340.	*	9.6	9.5	9.5	9.5	9.5	9.5	9.5	10.4	10.2	10.5	10.5	10.4	10.3	10.3	8.1	8.1	8.1	8.1	8.1	8.1
350.	*	9.8	9.8	9.8	9.7	9.7	9.6	9.6	10.7	10.5	10.8	10.8	10.8	10.8	10.6	8.4	8.4	8.4	8.3	8.3	8.3
360.	*	9.4	9.4	9.3	9.3	9.3	9.3	9.1	10.2	9.8	9.9	10.0	10.0	10.2	10.0	9.1	9.1	9.1	9.1	9.1	8.9
MAX	*	11.5	10.8	10.8	10.7	10.4	10.4	10.2	11.1	10.6	10.8	10.8	10.8	10.8	10.6	11.4	10.8	10.7	10.5	10.4	10.0
DEGR.	*	190	180	190	190	190	190	190	280	190	350	350	350	350	350	100	170	170	170	170	170

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

JOB: 2 LANE St.George 35K fu RUN: 35,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	8.9	10.0	9.6	9.6	9.7	9.8	9.9	9.9	8.3	8.0	8.0	8.0	8.0	8.0	8.2	8.0	8.0	8.0	8.0	8.0
10.	9.4	10.7	10.5	10.6	10.7	10.5	10.4	10.6	8.0	8.0	8.0	8.0	8.0	8.0	8.6	8.2	8.1	8.0	8.0	8.0
20.	9.2	10.5	10.2	10.3	10.1	10.2	10.2	10.2	8.0	8.0	8.0	8.0	8.0	8.0	8.6	8.4	8.2	8.2	8.0	8.0
30.	9.1	10.3	9.9	10.3	10.1	10.0	10.0	9.9	8.0	8.0	8.0	8.0	8.0	8.0	8.6	8.4	8.3	8.2	8.2	8.2
40.	8.9	10.2	10.3	10.2	9.9	9.8	9.8	9.8	8.1	8.1	8.1	8.1	8.1	8.1	8.6	8.5	8.4	8.4	8.3	8.3
50.	8.9	10.2	10.2	10.0	9.8	9.8	9.7	9.7	8.1	8.1	8.1	8.1	8.1	8.1	8.6	8.4	8.4	8.3	8.3	8.3
60.	8.8	10.5	10.2	9.8	9.8	9.7	9.6	9.6	8.1	8.1	8.1	8.1	8.1	8.1	8.6	8.4	8.4	8.3	8.3	8.3
70.	8.8	10.8	10.2	9.7	9.6	9.5	9.5	9.3	8.1	8.1	8.1	8.1	8.1	8.1	8.6	8.4	8.4	8.3	8.3	8.3
80.	8.8	11.1	10.2	9.6	9.5	9.3	9.3	9.3	8.7	8.7	8.7	8.7	8.6	8.6	9.0	8.9	8.8	8.8	8.8	8.8
90.	8.9	10.6	9.7	9.2	9.2	9.2	9.2	9.2	9.9	9.9	9.9	9.8	9.8	9.7	10.5	10.1	10.0	10.0	10.1	9.9
100.	8.9	9.9	9.4	9.2	9.2	9.2	9.2	9.2	10.3	10.3	10.3	10.3	10.3	10.1	10.7	10.6	10.8	10.3	10.4	10.3
110.	8.9	9.4	9.4	9.2	9.2	9.2	9.2	9.2	9.9	9.9	9.9	9.9	9.9	9.9	10.1	10.0	10.0	10.0	10.0	10.0
120.	9.1	9.4	9.4	9.3	9.3	9.3	9.3	9.3	9.7	9.7	9.7	9.7	9.7	9.7	9.8	9.9	9.9	9.8	9.8	9.7
130.	9.2	9.6	9.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	10.1	10.0	9.8	9.7	9.7	9.7
140.	9.2	9.7	9.5	9.5	9.5	9.5	9.5	9.5	9.4	9.3	9.3	9.3	9.3	9.3	10.1	9.8	9.7	9.7	9.6	9.6
150.	9.4	9.9	9.7	9.7	9.7	9.7	9.7	9.7	9.3	9.2	9.2	9.2	9.2	9.2	10.2	9.7	9.7	9.6	9.5	9.5
160.	9.4	10.1	10.0	10.0	10.0	10.0	10.0	10.0	9.4	9.2	9.2	9.2	9.2	9.2	10.1	9.6	9.5	9.4	9.4	9.2
170.	10.1	10.4	10.4	10.4	10.4	10.3	10.3	10.2	9.4	9.2	9.2	9.2	9.2	9.2	10.1	9.6	9.4	9.2	9.2	9.2
180.	9.9	9.9	9.9	9.9	9.9	9.9	9.8	9.7	10.0	9.5	9.3	9.3	9.3	9.2	9.7	9.2	9.2	9.2	9.2	9.1
190.	8.8	8.7	8.7	8.7	8.7	8.6	8.6	8.6	10.4	9.9	9.5	9.4	9.4	9.4	9.0	9.0	9.0	9.0	9.0	9.0
200.	8.3	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.4	9.9	9.7	9.6	9.5	9.4	9.0	9.0	9.0	9.0	9.0	9.0
210.	8.3	8.1	8.1	8.1	8.1	8.1	8.1	8.1	10.4	9.9	9.7	9.7	9.6	9.6	9.1	9.1	9.1	9.1	9.1	9.1
220.	8.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0	10.3	10.0	9.8	9.8	9.7	9.7	9.2	9.2	9.2	9.2	9.2	9.2

230.	*	8.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0	10.3	10.1	9.9	9.9	9.8	9.8	9.3	9.3	9.3	9.3	9.3	9.3
240.	*	8.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0	10.2	10.2	10.0	10.1	10.1	10.0	9.4	9.4	9.4	9.4	9.4	9.4
250.	*	8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.0	10.4	10.6	10.4	10.3	10.2	10.1	9.7	9.7	9.7	9.7	9.7	9.7
260.	*	8.1	8.6	8.0	8.0	8.0	8.0	8.0	8.0	10.8	11.0	10.9	11.0	10.7	10.5	10.1	10.1	10.0	10.0	9.9	9.9
270.	*	8.0	9.6	8.4	8.1	8.1	8.1	8.1	8.0	10.3	10.2	10.2	10.1	10.3	10.2	9.7	9.6	9.6	9.6	9.6	9.4
280.	*	8.0	10.1	8.8	8.4	8.3	8.1	8.1	8.1	9.2	8.9	8.9	8.9	8.8	8.8	8.6	8.6	8.6	8.5	8.5	8.5
290.	*	8.0	9.9	8.8	8.5	8.4	8.3	8.1	8.1	8.7	8.4	8.4	8.3	8.3	8.3	8.1	8.1	8.1	8.1	8.1	8.1
300.	*	8.0	9.6	8.8	8.5	8.4	8.3	8.3	8.3	8.7	8.4	8.4	8.3	8.3	8.3	8.1	8.1	8.1	8.1	8.1	8.1
310.	*	8.0	9.4	8.6	8.5	8.4	8.4	8.3	8.3	8.6	8.4	8.4	8.4	8.3	8.3	8.1	8.1	8.1	8.1	8.1	8.1
320.	*	8.0	9.3	8.6	8.4	8.4	8.3	8.3	8.3	8.6	8.4	8.4	8.4	8.3	8.3	8.1	8.1	8.1	8.1	8.1	8.1
330.	*	8.0	9.1	8.7	8.5	8.5	8.4	8.4	8.4	8.6	8.5	8.3	8.3	8.2	8.2	8.0	8.0	8.0	8.0	8.0	8.0
340.	*	8.1	9.1	8.7	8.5	8.5	8.4	8.4	8.4	8.6	8.5	8.3	8.2	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0
350.	*	8.3	9.3	9.1	8.8	8.8	8.8	8.8	8.8	8.6	8.3	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
360.	*	8.9	10.0	9.6	9.6	9.7	9.8	9.9	9.9	8.3	8.0	8.0	8.0	8.0	8.0	8.2	8.0	8.0	8.0	8.0	8.0
MAX	*	10.1	11.1	10.5	10.6	10.7	10.5	10.4	10.6	10.8	11.0	10.9	11.0	10.7	10.5	10.7	10.6	10.8	10.3	10.4	10.3
DEGR.	*	170	80	10	10	10	10	10	10	260	260	260	260	260	260	100	100	100	100	100	100

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
St. George, Washington County
35,000 ADT
Future Emission Rates

PAGE 6

JOB: 2 LANE St.George 35K fu RUN: 35,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	REC41	REC42	REC43	REC44	REC45	REC46	REC47	REC48	REC49	REC50	REC51	REC52
	CONCENTRATION (PPM)											
0.	9.4	8.9	8.9	8.9	8.9	8.9	9.3	9.0	9.0	9.0	9.0	9.0
10.	9.1	8.9	8.9	8.9	8.9	8.9	9.8	9.3	9.3	9.1	9.1	9.1
20.	9.1	8.9	8.9	8.9	8.9	8.9	9.9	9.5	9.4	9.3	9.3	9.1
30.	9.1	9.0	9.0	9.0	9.0	9.0	9.9	9.5	9.4	9.4	9.3	9.3
40.	9.2	9.1	9.1	9.1	9.1	9.1	10.0	9.6	9.5	9.5	9.4	9.4
50.	9.2	9.2	9.2	9.2	9.2	9.2	10.2	9.5	9.5	9.4	9.4	9.4
60.	9.3	9.3	9.3	9.3	9.3	9.3	10.0	9.8	9.7	9.7	9.7	9.7
70.	9.6	9.6	9.6	9.6	9.6	9.6	10.2	10.2	9.9	9.9	9.9	9.8
80.	9.9	9.9	9.9	9.8	9.8	9.7	10.7	10.8	10.8	10.5	10.3	10.4
90.	9.4	9.4	9.4	9.4	9.3	9.2	10.1	10.0	10.1	9.9	10.1	10.0
100.	8.5	8.5	8.4	8.4	8.4	8.4	9.3	9.1	8.9	9.0	9.0	8.8
110.	8.1	8.1	8.1	8.1	8.1	8.1	8.8	8.7	8.6	8.5	8.5	8.4
120.	8.1	8.1	8.1	8.1	8.1	8.1	8.8	8.6	8.5	8.4	8.4	8.4
130.	8.0	8.0	8.0	8.0	8.0	8.0	8.8	8.6	8.5	8.4	8.4	8.4
140.	8.0	8.0	8.0	8.0	8.0	8.0	8.7	8.6	8.5	8.5	8.4	8.4
150.	8.0	8.0	8.0	8.0	8.0	8.0	8.9	8.6	8.5	8.5	8.4	8.4
160.	8.0	8.0	8.0	8.0	8.0	8.0	9.0	8.6	8.5	8.4	8.2	8.2
170.	8.0	8.0	8.0	8.0	8.0	8.0	9.0	8.6	8.4	8.2	8.2	8.2
180.	8.7	8.3	8.2	8.2	8.2	8.1	8.6	8.2	8.2	8.2	8.2	8.1
190.	9.0	8.7	8.3	8.2	8.2	8.2	8.0	8.0	8.0	8.0	8.0	8.0
200.	9.0	8.7	8.5	8.4	8.3	8.2	8.0	8.0	8.0	8.0	8.0	8.0
210.	8.9	8.7	8.5	8.5	8.4	8.4	8.0	8.0	8.0	8.0	8.0	8.0
220.	8.8	8.6	8.5	8.5	8.4	8.4	8.0	8.0	8.0	8.0	8.0	8.0

230.	*	8.8	8.5	8.5	8.5	8.4	8.4	8.0	8.0	8.0	8.0	8.0	8.0
240.	*	8.9	8.6	8.6	8.5	8.5	8.5	8.0	8.0	8.0	8.0	8.0	8.0
250.	*	8.9	8.7	8.6	8.5	8.5	8.4	8.1	8.1	8.1	8.1	8.1	8.1
260.	*	9.4	9.1	9.1	8.9	8.9	8.8	8.6	8.6	8.5	8.5	8.5	8.5
270.	*	10.1	9.8	9.9	9.8	9.8	9.8	9.6	9.6	9.6	9.6	9.4	9.4
280.	*	10.4	10.5	10.4	10.3	10.1	10.2	10.0	10.0	9.9	9.9	9.9	9.9
290.	*	10.1	10.1	9.9	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.7	9.6
300.	*	9.8	9.8	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
310.	*	9.9	9.6	9.5	9.5	9.4	9.4	9.2	9.2	9.2	9.2	9.2	9.2
320.	*	9.8	9.5	9.4	9.4	9.3	9.3	9.2	9.2	9.2	9.2	9.2	9.2
330.	*	9.7	9.5	9.3	9.3	9.2	9.2	9.1	9.1	9.1	9.1	9.1	9.1
340.	*	9.7	9.4	9.2	9.1	9.0	8.9	9.1	9.1	9.1	9.1	9.1	9.1
350.	*	9.7	9.2	9.0	8.9	8.9	8.9	9.1	9.1	9.1	9.1	9.1	9.1
360.	*	9.4	8.9	8.9	8.9	8.9	8.9	9.3	9.0	9.0	9.0	9.0	9.0
MAX	*	10.4	10.5	10.4	10.3	10.1	10.2	10.7	10.8	10.8	10.5	10.3	10.4
DEGR.	*	280	280	280	280	280	280	80	80	80	80	80	80

THE HIGHEST CONCENTRATION OF 11.50 PPM OCCURRED AT RECEPTOR REC1 .

CAL3QHC Screening
Input

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

```
'2 LANE Rural 45K Fu' 60. 10.  0.  0.  52   0.3048 1 1
'REC 1'        41.    41.    6.
'REC 2'        41.    116.   6.
'REC 3'        41.    191.   6.
'REC 4'        41.    266.   6.
'REC 5'        41.    341.   6.
'REC 6'        41.    416.   6.
'REC 7'        41.    491.   6.
'REC 8'        41.    -41.   6.
'REC 9'        41.    -116.  6.
'REC 10'       41.    -191.  6.
'REC 11'       41.    -266.  6.
'REC 12'       41.    -341.  6.
'REC 13'       41.    -416.  6.
'REC 14'       41.    -491.  6.
'REC 15'       -41.   41.    6.
'REC 16'       -41.   116.   6.
'REC 17'       -41.   191.   6.
'REC 18'       -41.   266.   6.
'REC 19'       -41.   341.   6.
'REC 20'       -41.   416.   6.
'REC 21'       -41.   491.   6.
'REC 22'       -41.   -41.   6.
'REC 23'       -41.   -116.  6.
'REC 24'       -41.   -191.  6.
'REC 25'       -41.   -255.  6.
'REC 26'       -41.   -341.  6.
'REC 27'        -41.  -416.  6.
'REC 28'       -41.   -491.  6.
'REC 29'       116.   41.    6.
'REC 30'       191.   41.    6.
'REC 31'       266.   41.    6.
'REC 32'       341.   41.    6.
'REC 33'       416.   41.    6.
'REC 34'       496.   41.    6.
'REC 35'       -116.  41.    6.
'REC 36'       -191.  41.    6.
'REC 37'       -266.  41.    6.
'REC 38'       -341.  41.    6.
'REC 39'       -416.  41.    6.
'REC 40'       -496.  41.    6.
'REC 41'       116.   -41.   6.
'REC 42'       191.   -41.   6.
'REC 43'       266.   -41.   6.
'REC 44'       341.   -41.   6.
'REC 45'       416.   -41.   6.
'REC 46'       491.   -41.   6.
'REC 47'       -116.  -41.   6.
'REC 48'       -191.  -41.   6.
'REC 49'       -266.  -41.   6.
'REC 50'       -341.  -41.   6.
'REC 51'       -416.  -41.   6.
'REC 52'       -491.  -53.   6.
'45,000 AADT'     16  1  0  'C'
1
'ARTERIAL WB APPR.'    'AG'       0.   19.     1000.     19.  3240.   8.6    1. 44.
2
'ARTERIAL WB QUEUE'    'AG'       53.  19.     1000.     19.  1. 12. 1
    100 58 2. 3240 87.5  1800 1 3
1
'ARTERIAL WB DEP'      'AG'       0.   19.    -1000.     19.   3132.   8.6   1. 44.
2
'ARTERIAL WB L QUEUE'  'AG'       53.   0.     1000.     0.  1. 12. 1
    100 58 2. 324 87.5  1800 1 3
```

```
1
'ARTERIAL EB APPR.'    'AG'        0.  -19.   -1000.    -19.  2160.   8.6    1. 44.
2
'ARTERIAL EB QUEUE'    'AG'      -53. -19.     -1000.    -19.  1. 12. 1
    100 58 2. 2160 87.5  1800 1 3
1
'ARTERIAL EB DEP'      'AG'        0.  -19.    1000.    -19.   2268.   8.6   1. 44.
2
'ARTERIAL EB L QUEUE'  'AG'      -53.   0.     -1000.      0.  1. 12. 1
    100 58 2. 216 87.5  1800 1 3
1
'ARTERIAL NB APPR.'    'AG'       19.   0.       19.     -1000.  3240.   8.6    1. 44.
2
'ARTERIAL NB QUEUE'    'AG'       19.   -53.     19.     -1000.  1. 12. 1
    100 58 2. 3240 87.5  1800 1 3
1
'ARTERIAL NB DEP'      'AG'       19.    0.    19.        1000.   3132.   8.6   1. 44.
2
'ARTERIAL NB L QUEUE'  'AG'        0.  -53.     0.       -1000.      1.   12.    1
    100 58 2. 324 87.5  1800 1 3
1
'ARTERIAL SB APPR.'    'AG'      -19.  0.    -19.        1000.   2160.   8.6    1. 44.
2
'ARTERIAL SB QUEUE'    'AG'      -19. 53.    -19.       -1000.  1. 12. 1
    100 58 2. 2160 87.5  1800 1 3
1
'ARTERIAL SB DEP'      'AG'      -19.  0.    -19.       -1000.   2268.   8.6   1. 44.
2
'ARTERIAL SB L QUEUE'  'AG'        0.  53.      0.        1000.  1. 12. 1
    100 58 2. 216 87.5  1800 1 3
1.0 0.  5  1000. 3.  'Y' 10  0 36
```

CAL3QHC Screening Output

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 95221 PAGE 1

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

DATE : 5/ 6/ 3
TIME : 8:31:39

The MODE flag has been set to C for calculating CO averages.

SITE & METEOROLOGICAL VARIABLES

VS = .0 CM/S VD = .0 CM/S Z0 = 10. CM
U = 1.0 M/S CLAS = 5 (E) ATIM = 60. MINUTES MIXH = 1000. M AMB = 3.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. ARTERIAL WB APPR.	.0	19.0	1000.0	19.0	1000.	90.	AG	3240.	8.6	1.0	44.0		
2. ARTERIAL WB QUEUE	53.0	19.0	26841.3	19.0	*****	90.	AG	136.	100.0	1.0	12.0	4.74	*****
3. ARTERIAL WB DEP	.0	19.0	-1000.0	19.0	1000.	270.	AG	3132.	8.6	1.0	44.0		
4. ARTERIAL WB L QUEUE	53.0	.0	155.8	.0	103.	90.	AG	136.	100.0	1.0	12.0	.47	5.2
5. ARTERIAL EB APPR.	.0	-19.0	-1000.0	-19.0	1000.	270.	AG	2160.	8.6	1.0	44.0		
6. ARTERIAL EB QUEUE	-53.0	-19.0	-15667.8	-19.0	*****	270.	AG	136.	100.0	1.0	12.0	3.16	793.2
7. ARTERIAL EB DEP	.0	-19.0	1000.0	-19.0	1000.	90.	AG	2268.	8.6	1.0	44.0		
8. ARTERIAL EB L QUEUE	-53.0	.0	-121.5	.0	69.	270.	AG	136.	100.0	1.0	12.0	.32	3.5
9. ARTERIAL NB APPR.	19.0	.0	19.0	-1000.0	1000.	180.	AG	3240.	8.6	1.0	44.0		
10. ARTERIAL NB QUEUE	19.0	-53.0	19.0	-26841.3	*****	180.	AG	136.	100.0	1.0	12.0	4.74	*****
11. ARTERIAL NB DEP	19.0	.0	19.0	1000.0	1000.	360.	AG	3132.	8.6	1.0	44.0		
12. ARTERIAL NB L QUEUE	.0	-53.0	.0	-155.8	103.	180.	AG	136.	100.0	1.0	12.0	.47	5.2
13. ARTERIAL SB APPR.	-19.0	.0	-19.0	1000.0	1000.	360.	AG	2160.	8.6	1.0	44.0		
14. ARTERIAL SB QUEUE	-19.0	53.0	-19.0	-15561.8	*****	180.	AG	136.	100.0	1.0	12.0	3.16	793.2
15. ARTERIAL SB DEP	-19.0	.0	-19.0	-1000.0	1000.	180.	AG	2268.	8.6	1.0	44.0		
16. ARTERIAL SB L QUEUE	.0	53.0	.0	121.5	69.	360.	AG	136.	100.0	1.0	12.0	.32	3.5

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

DATE : 5/ 6/ 3
TIME : 8:31:39

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. ARTERIAL WB QUEUE	100	58	2.0	3240	1800	87.50	1	3
4. ARTERIAL WB L QUEUE	100	58	2.0	324	1800	87.50	1	3
6. ARTERIAL EB QUEUE	100	58	2.0	2160	1800	87.50	1	3
8. ARTERIAL EB L QUEUE	100	58	2.0	216	1800	87.50	1	3
10. ARTERIAL NB QUEUE	100	58	2.0	3240	1800	87.50	1	3
12. ARTERIAL NB L QUEUE	100	58	2.0	324	1800	87.50	1	3
14. ARTERIAL SB QUEUE	100	58	2.0	2160	1800	87.50	1	3
16. ARTERIAL SB L QUEUE	100	58	2.0	216	1800	87.50	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. REC 1	41.0	41.0	6.0
2. REC 2	41.0	116.0	6.0
3. REC 3	41.0	191.0	6.0
4. REC 4	41.0	266.0	6.0
5. REC 5	41.0	341.0	6.0
6. REC 6	41.0	416.0	6.0
7. REC 7	41.0	491.0	6.0
8. REC 8	41.0	-41.0	6.0
9. REC 9	41.0	-116.0	6.0
10. REC 10	41.0	-191.0	6.0
11. REC 11	41.0	-266.0	6.0
12. REC 12	41.0	-341.0	6.0
13. REC 13	41.0	-416.0	6.0
14. REC 14	41.0	-491.0	6.0

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15. REC 15                *       -41.0        41.0        6.0    *
16. REC 16                *       -41.0       116.0        6.0    *
17. REC 17                *       -41.0       191.0        6.0    *
18. REC 18                *       -41.0       266.0        6.0    *
19. REC 19                *       -41.0       341.0        6.0    *
20. REC 20                *       -41.0       416.0        6.0    *
21. REC 21                *       -41.0       491.0        6.0    *
22. REC 22                *       -41.0       -41.0        6.0    *
23. REC 23                *       -41.0      -116.0        6.0    *
24. REC 24                *       -41.0      -191.0        6.0    *
25. REC 25                *       -41.0      -255.0        6.0    *
26. REC 26                *       -41.0      -341.0        6.0    *
27. REC 27                *       -41.0      -416.0        6.0    *
28. REC 28                *       -41.0      -491.0        6.0    *
29. REC 29                *       116.0        41.0        6.0    *
30. REC 30                *       191.0        41.0        6.0    *
31. REC 31                *       266.0        41.0        6.0    *
32. REC 32                *       341.0        41.0        6.0    *
33. REC 33                *       416.0        41.0        6.0    *
34. REC 34                *       496.0        41.0        6.0    *
35. REC 35                *      -116.0        41.0        6.0    *
36. REC 36                *      -191.0        41.0        6.0    *
37. REC 37                *      -266.0        41.0        6.0    *
```

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

PAGE 3

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

DATE : 5/ 6/ 3
TIME : 8:31:39

RECEPTOR LOCATIONS

RECEPTOR	X (FT)	Y (FT)	Z (FT)
38. REC 38	-341.0	41.0	6.0
39. REC 39	-416.0	41.0	6.0
40. REC 40	-496.0	41.0	6.0
41. REC 41	116.0	-41.0	6.0
42. REC 42	191.0	-41.0	6.0
43. REC 43	266.0	-41.0	6.0
44. REC 44	341.0	-41.0	6.0
45. REC 45	416.0	-41.0	6.0
46. REC 46	491.0	-41.0	6.0
47. REC 47	-116.0	-41.0	6.0
48. REC 48	-191.0	-41.0	6.0
49. REC 49	-266.0	-41.0	6.0
50. REC 50	-341.0	-41.0	6.0
51. REC 51	-416.0	-41.0	6.0
52. REC 52	-491.0	-53.0	6.0

CAL3QHC Screening – cont.
Output
Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
0.	5.4	5.3	5.3	5.2	5.1	5.0	4.9	6.7	6.3	6.2	6.2	6.4	6.5	6.5	4.9	4.8	4.8	4.7	4.6	4.6
10.	3.5	3.5	3.4	3.4	3.4	3.4	3.4	4.9	4.4	4.2	4.0	4.1	4.0	3.9	5.8	5.7	5.7	5.7	5.5	5.5
20.	3.1	3.1	3.1	3.1	3.1	3.1	3.1	4.7	4.0	3.8	3.7	3.6	3.6	3.5	5.2	5.1	5.1	5.1	5.1	5.1
30.	3.2	3.1	3.1	3.1	3.1	3.1	3.1	5.0	4.1	3.9	3.7	3.6	3.6	3.5	5.0	4.7	4.7	4.7	4.7	4.7
40.	3.2	3.1	3.1	3.1	3.1	3.1	3.1	4.9	4.1	3.7	3.7	3.6	3.6	3.5	4.9	4.5	4.5	4.5	4.5	4.5
50.	3.2	3.1	3.1	3.1	3.1	3.1	3.1	5.2	4.2	3.9	3.7	3.7	3.6	3.6	4.8	4.3	4.3	4.3	4.3	4.3
60.	3.2	3.1	3.1	3.1	3.1	3.1	3.1	5.5	4.2	3.9	3.7	3.7	3.6	3.5	4.8	4.2	4.2	4.2	4.2	4.2
70.	3.1	3.0	3.0	3.0	3.0	3.0	3.0	5.8	4.3	3.9	3.7	3.4	3.3	3.1	4.8	4.2	4.2	4.2	4.2	4.2
80.	3.6	3.0	3.0	3.0	3.0	3.0	3.0	6.4	4.3	3.6	3.4	3.2	3.2	3.2	5.2	4.3	4.2	4.2	4.2	4.2
90.	6.3	3.7	3.3	3.2	3.2	3.1	3.1	5.5	3.5	3.2	3.2	3.1	3.1	3.1	7.8	5.1	4.5	4.4	4.4	4.3
100.	7.1	4.4	3.7	3.3	3.2	3.2	3.2	3.3	3.0	3.0	3.0	3.0	3.0	3.0	8.7	5.8	5.0	4.6	4.4	4.4
110.	6.3	4.4	4.0	3.7	3.4	3.2	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	7.3	5.8	5.2	5.0	4.6	4.5
120.	5.9	4.3	4.0	3.8	3.7	3.5	3.5	3.2	3.1	3.1	3.1	3.1	3.1	3.1	6.5	5.8	5.1	4.9	4.8	4.8
130.	5.5	4.2	3.8	3.7	3.7	3.6	3.5	3.2	3.1	3.1	3.1	3.1	3.1	3.1	6.5	5.9	5.0	4.9	4.9	4.8
140.	5.2	4.2	3.8	3.7	3.7	3.5	3.5	3.2	3.1	3.1	3.1	3.1	3.1	3.1	6.4	5.7	5.3	5.1	5.1	4.9
150.	5.0	4.3	3.9	3.7	3.6	3.5	3.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	6.9	5.7	5.7	5.4	5.2	5.1
160.	4.7	4.2	3.8	3.8	3.6	3.5	3.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	7.6	6.5	6.2	5.7	5.8	5.6
170.	5.0	4.5	4.3	4.2	4.1	4.1	4.0	3.6	3.6	3.6	3.6	3.5	3.5	3.5	8.7	7.9	7.4	7.0	6.7	6.7
180.	8.1	7.6	7.3	7.1	6.8	6.8	6.7	6.8	6.8	6.8	6.7	6.5	6.5	6.4	7.6	7.0	6.8	6.5	6.4	6.4
190.	9.0	8.0	7.7	7.5	7.3	7.2	6.8	7.6	7.6	7.5	7.5	7.5	7.3	7.3	4.8	4.4	4.1	4.1	3.9	3.9
200.	7.3	6.7	6.4	6.0	5.9	5.7	5.7	6.6	6.4	6.4	6.4	6.4	6.4	6.4	4.8	4.0	3.8	3.7	3.6	3.5
210.	6.6	6.0	5.8	5.5	5.3	5.2	5.2	6.1	5.8	5.8	5.8	5.8	5.8	5.8	4.9	4.0	3.8	3.7	3.6	3.5
220.	6.6	5.9	5.3	5.2	5.2	5.0	5.0	5.8	5.5	5.4	5.4	5.4	5.4	5.4	5.0	4.0	3.7	3.7	3.7	3.5

230.	*	6.4	5.9	5.1	5.0	5.0	4.9	4.8	5.4	5.3	5.1	5.1	5.1	5.1	5.1	5.3	4.1	3.8	3.7	3.7	3.6
240.	*	6.6	5.7	5.1	4.9	4.9	4.8	4.7	5.2	5.2	4.9	4.9	4.9	4.9	4.9	5.3	4.1	3.8	3.6	3.6	3.4
250.	*	7.4	5.8	5.3	5.0	4.7	4.6	4.5	4.9	5.1	4.9	4.9	4.9	4.9	4.9	5.7	4.3	4.0	3.7	3.4	3.2
260.	*	8.3	5.7	4.8	4.6	4.4	4.4	4.3	5.0	5.0	4.8	4.8	4.8	4.8	4.8	6.7	4.3	3.6	3.3	3.2	3.2
270.	*	7.4	5.1	4.5	4.5	4.4	4.4	4.4	7.2	5.5	5.0	5.0	4.9	4.9	4.9	5.9	3.6	3.2	3.2	3.1	3.1
280.	*	4.9	4.3	4.2	4.2	4.2	4.2	4.2	8.1	6.4	5.5	5.2	5.0	5.0	5.0	3.5	3.0	3.0	3.0	3.0	3.0
290.	*	4.6	4.3	4.3	4.3	4.3	4.3	4.3	6.9	6.5	5.8	5.6	5.4	5.2	5.0	3.1	3.0	3.0	3.0	3.0	3.0
300.	*	4.7	4.3	4.3	4.3	4.3	4.3	4.3	6.4	6.3	5.8	5.5	5.5	5.4	5.3	3.1	3.0	3.0	3.0	3.0	3.0
310.	*	4.8	4.4	4.4	4.4	4.4	4.4	4.4	6.4	6.6	5.9	5.7	5.6	5.6	5.5	3.2	3.1	3.1	3.1	3.1	3.1
320.	*	5.0	4.6	4.6	4.6	4.6	4.6	4.6	6.3	6.4	6.4	6.0	5.9	5.8	5.8	3.2	3.1	3.1	3.1	3.1	3.1
330.	*	5.1	4.8	4.8	4.8	4.8	4.8	4.8	6.4	6.4	6.7	6.4	6.3	6.2	6.2	3.2	3.1	3.1	3.1	3.1	3.1
340.	*	5.4	5.3	5.3	5.3	5.3	5.3	5.3	6.8	6.7	6.9	7.0	7.0	6.7	6.8	3.1	3.1	3.1	3.1	3.1	3.1
350.	*	6.2	6.2	6.1	6.1	6.0	6.0	5.9	7.5	7.1	7.6	7.7	7.6	7.7	7.7	3.3	3.3	3.3	3.3	3.3	3.3
360.	*	5.4	5.3	5.3	5.2	5.1	5.0	4.9	6.7	6.3	6.2	6.2	6.4	6.5	6.5	4.9	4.8	4.8	4.7	4.6	4.6
MAX	*	9.0	8.0	7.7	7.5	7.3	7.2	6.8	8.1	7.6	7.6	7.7	7.6	7.7	7.7	8.7	7.9	7.4	7.0	6.7	6.7
DEGR.	*	190	190	190	190	190	190	190	280	190	350	350	350	350	350	100	170	170	170	170	170

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
0.	4.4	6.1	5.8	5.7	5.9	5.9	5.9	6.0	3.3	3.0	3.0	3.0	3.0	3.0	3.2	3.0	3.0	3.0	3.0	3.0
10.	5.4	7.4	7.2	7.3	7.2	7.3	7.1	7.2	3.0	3.0	3.0	3.0	3.0	3.0	3.9	3.4	3.2	3.0	3.0	3.0
20.	5.1	6.9	6.4	6.8	6.7	6.8	6.6	6.5	3.0	3.0	3.0	3.0	3.0	3.0	4.1	3.7	3.5	3.2	3.2	3.0
30.	4.7	6.6	6.0	6.7	6.4	6.1	6.1	6.0	3.1	3.1	3.1	3.1	3.1	3.1	4.0	3.8	3.6	3.6	3.5	3.3
40.	4.5	6.4	6.2	6.1	5.7	5.7	5.7	5.6	3.1	3.1	3.1	3.1	3.1	3.1	3.9	3.7	3.6	3.5	3.5	3.4
50.	4.3	6.3	6.5	5.8	5.5	5.5	5.4	5.4	3.1	3.1	3.1	3.1	3.1	3.1	3.8	3.6	3.6	3.5	3.4	3.4
60.	4.2	6.8	6.4	5.7	5.6	5.5	5.4	5.3	3.1	3.1	3.1	3.1	3.1	3.1	3.9	3.6	3.5	3.5	3.4	3.4
70.	4.2	7.3	6.3	5.7	5.6	5.3	5.1	4.9	3.1	3.1	3.1	3.1	3.1	3.1	3.9	3.7	3.5	3.5	3.4	3.4
80.	4.2	8.1	6.2	5.3	5.1	4.9	4.9	4.9	3.6	3.6	3.6	3.5	3.5	3.5	4.4	4.2	4.0	4.0	3.9	3.9
90.	4.3	7.1	5.6	5.0	5.0	4.9	4.9	4.9	6.3	6.3	6.2	6.0	6.0	5.9	7.1	6.9	6.7	6.5	6.3	6.4
100.	4.4	5.0	4.9	4.7	4.7	4.7	4.7	4.7	7.1	7.0	7.0	7.0	6.8	6.8	7.8	7.4	7.3	7.4	7.1	7.0
110.	4.4	5.1	5.0	4.8	4.8	4.8	4.8	4.8	6.1	6.1	6.1	6.1	6.1	6.1	6.4	6.4	6.2	6.4	6.3	6.1
120.	4.6	5.3	5.2	4.9	4.9	4.9	4.9	4.9	5.5	5.5	5.5	5.5	5.5	5.5	5.9	6.1	5.9	5.7	5.7	5.6
130.	4.7	5.3	5.1	4.9	4.9	4.9	4.9	4.9	5.2	5.1	5.1	5.1	5.1	5.1	5.9	5.6	5.6	5.5	5.5	5.4
140.	4.9	5.6	5.3	5.2	5.2	5.2	5.2	5.2	5.1	4.9	4.9	4.9	4.9	4.9	6.4	5.5	5.3	5.3	5.2	5.2
150.	5.1	5.9	5.6	5.6	5.6	5.6	5.6	5.6	5.0	4.7	4.7	4.7	4.7	4.7	6.2	5.5	5.2	5.2	5.1	5.0
160.	5.5	6.4	6.2	6.2	6.2	6.2	6.2	6.1	4.9	4.7	4.7	4.7	4.7	4.7	6.3	5.6	5.5	5.1	4.9	4.7
170.	6.5	7.2	7.2	7.1	7.1	7.0	6.9	6.9	4.8	4.6	4.6	4.6	4.6	4.6	6.3	5.3	5.0	4.8	4.8	4.8
180.	6.3	6.3	6.3	6.1	6.1	6.0	5.9	5.8	5.8	5.1	5.0	4.9	4.8	4.8	5.6	4.9	4.9	4.7	4.7	4.7
190.	3.9	3.4	3.4	3.4	3.4	3.4	3.4	3.4	6.5	5.6	5.2	5.0	5.0	4.9	4.5	4.4	4.4	4.4	4.4	4.4
200.	3.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	6.5	5.9	5.7	5.2	5.1	5.0	4.5	4.5	4.5	4.5	4.5	4.5
210.	3.5	3.1	3.1	3.1	3.1	3.1	3.1	3.1	6.5	5.7	5.5	5.4	5.4	5.2	4.5	4.5	4.5	4.5	4.5	4.5
220.	3.5	3.2	3.1	3.1	3.1	3.1	3.1	3.1	6.8	5.8	5.6	5.6	5.5	5.4	4.6	4.6	4.6	4.6	4.6	4.6

230.	*	3.5	3.2	3.1	3.1	3.1	3.1	3.1	3.1	6.4	6.3	5.8	5.8	5.6	5.6	4.9	4.9	4.9	4.9	4.9	4.9
240.	*	3.4	3.1	3.0	3.0	3.0	3.0	3.0	3.0	6.3	6.6	6.3	6.1	6.0	6.0	5.1	5.1	5.1	5.1	5.1	5.1
250.	*	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	7.0	7.0	6.8	6.9	6.6	6.6	5.6	5.6	5.6	5.6	5.6	5.6
260.	*	3.1	3.4	3.0	3.0	3.0	3.0	3.0	3.0	7.6	7.9	7.9	7.6	7.8	7.7	6.7	6.6	6.6	6.5	6.5	6.4
270.	*	3.1	5.7	3.5	3.2	3.2	3.1	3.1	3.1	6.9	6.8	6.6	6.8	6.8	6.8	5.8	5.8	5.7	5.6	5.5	5.4
280.	*	3.0	6.6	4.3	3.7	3.4	3.2	3.2	3.2	4.3	4.1	4.0	3.8	3.8	3.8	3.5	3.4	3.4	3.4	3.4	3.4
290.	*	3.0	5.8	4.4	3.9	3.7	3.3	3.3	3.1	3.9	3.7	3.6	3.5	3.4	3.4	3.1	3.1	3.1	3.1	3.1	3.1
300.	*	3.0	5.4	4.1	3.9	3.6	3.6	3.5	3.3	3.9	3.7	3.6	3.5	3.4	3.4	3.1	3.1	3.1	3.1	3.1	3.1
310.	*	3.1	5.3	4.1	3.8	3.7	3.6	3.6	3.5	3.9	3.6	3.6	3.6	3.4	3.4	3.1	3.1	3.1	3.1	3.1	3.1
320.	*	3.1	5.0	4.0	3.7	3.7	3.6	3.5	3.5	3.9	3.7	3.6	3.6	3.5	3.4	3.1	3.1	3.1	3.1	3.1	3.1
330.	*	3.1	4.8	4.1	3.7	3.6	3.6	3.5	3.5	4.0	3.8	3.6	3.6	3.4	3.4	3.1	3.1	3.1	3.1	3.1	3.1
340.	*	3.1	4.6	4.1	3.8	3.6	3.6	3.5	3.5	4.1	3.8	3.5	3.3	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0
350.	*	3.3	4.6	4.3	4.0	3.9	3.9	3.8	3.8	4.0	3.4	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
360.	*	4.4	6.1	5.8	5.7	5.9	5.9	5.9	6.0	3.3	3.0	3.0	3.0	3.0	3.0	3.2	3.0	3.0	3.0	3.0	3.0
MAX	*	6.5	8.1	7.2	7.3	7.2	7.3	7.1	7.2	7.6	7.9	7.9	7.6	7.8	7.7	7.8	7.4	7.3	7.4	7.1	7.0
DEGR.	*	170	80	10	10	10	10	10	10	260	260	260	260	260	260	100	100	100	100	100	100

CAL3QHC Screening – cont.
Output

Two Lanes Each Direction
Rural Utah
45,000 ADT
Future Emission Rates

JOB: 2 LANE Rural 45K Fu RUN: 45,000 AADT

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42	REC43	REC44	REC45	REC46	REC47	REC48	REC49	REC50	REC51	REC52
0.	5.0	4.5	4.5	4.5	4.5	4.5	4.9	4.5	4.5	4.5	4.5	4.3
10.	4.6	4.4	4.4	4.4	4.4	4.4	5.7	4.9	4.7	4.5	4.5	4.3
20.	4.6	4.4	4.4	4.4	4.4	4.4	5.9	5.3	5.1	5.0	4.8	4.4
30.	4.9	4.6	4.6	4.6	4.6	4.6	5.7	5.2	5.0	5.0	4.9	4.8
40.	4.7	4.5	4.5	4.5	4.5	4.5	5.9	5.3	5.2	5.1	5.1	4.7
50.	4.9	4.8	4.8	4.8	4.8	4.8	6.0	5.5	5.4	5.3	5.2	4.9
60.	5.1	5.1	5.1	5.1	5.1	5.1	6.1	6.1	5.7	5.6	5.5	5.2
70.	5.6	5.6	5.6	5.6	5.6	5.5	6.5	6.5	6.4	6.2	6.0	5.5
80.	6.4	6.3	6.2	6.2	6.1	6.1	7.5	7.6	7.3	7.3	7.2	6.1
90.	5.5	5.3	5.3	5.2	5.1	5.0	6.4	6.3	6.3	6.2	6.3	5.3
100.	3.3	3.3	3.3	3.3	3.3	3.3	4.5	4.1	4.0	4.1	4.0	3.5
110.	3.1	3.1	3.1	3.1	3.1	3.1	4.2	3.9	3.8	3.7	3.7	3.5
120.	3.1	3.1	3.1	3.1	3.1	3.1	4.3	4.0	3.8	3.7	3.7	3.5
130.	3.1	3.1	3.1	3.1	3.1	3.1	4.3	3.8	3.8	3.7	3.7	3.5
140.	3.1	3.1	3.1	3.1	3.1	3.1	4.4	4.0	3.8	3.8	3.7	3.6
150.	3.0	3.0	3.0	3.0	3.0	3.0	4.3	4.0	3.7	3.7	3.6	3.4
160.	3.0	3.0	3.0	3.0	3.0	3.0	4.6	4.1	3.9	3.5	3.4	3.2
170.	3.0	3.0	3.0	3.0	3.0	3.0	4.7	3.9	3.6	3.4	3.4	3.4
180.	4.0	3.5	3.4	3.3	3.2	3.2	3.8	3.4	3.4	3.2	3.2	3.2
190.	4.7	3.9	3.5	3.4	3.4	3.3	3.0	3.0	3.0	3.0	3.0	3.0
200.	4.6	4.2	3.9	3.5	3.3	3.2	3.0	3.0	3.0	3.0	3.0	3.0
210.	4.4	4.0	3.8	3.7	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0
220.	4.4	3.9	3.8	3.8	3.7	3.6	3.1	3.1	3.1	3.1	3.1	3.0

230.	*	4.3	3.9	3.8	3.8	3.6	3.6	3.1	3.1	3.1	3.1	3.1	3.0
240.	*	4.4	4.0	3.8	3.7	3.6	3.6	3.1	3.1	3.1	3.1	3.1	3.0
250.	*	4.3	3.9	3.9	3.7	3.6	3.6	3.1	3.1	3.1	3.1	3.1	3.0
260.	*	4.6	4.2	4.2	4.1	4.1	4.0	3.4	3.4	3.4	3.4	3.4	3.1
270.	*	6.6	6.2	6.2	6.2	6.1	6.1	5.6	5.6	5.5	5.4	5.4	4.2
280.	*	7.1	6.9	6.9	6.8	6.6	6.6	6.5	6.5	6.5	6.3	6.3	5.2
290.	*	6.2	6.3	6.0	5.9	5.7	5.8	5.7	5.7	5.7	5.7	5.7	5.2
300.	*	5.6	6.0	5.7	5.5	5.4	5.4	5.2	5.2	5.2	5.2	5.2	4.9
310.	*	5.8	5.6	5.3	5.3	5.1	5.1	4.9	4.9	4.9	4.9	4.9	4.6
320.	*	5.7	5.2	5.0	5.0	4.9	4.8	4.7	4.7	4.7	4.7	4.7	4.4
330.	*	5.8	5.3	5.1	5.1	5.0	4.9	4.5	4.5	4.5	4.5	4.5	4.5
340.	*	5.7	5.2	4.9	4.7	4.6	4.5	4.6	4.6	4.6	4.6	4.6	4.4
350.	*	5.6	4.8	4.6	4.4	4.4	4.4	4.6	4.5	4.5	4.5	4.5	4.3
360.	*	5.0	4.5	4.5	4.5	4.5	4.5	4.9	4.5	4.5	4.5	4.5	4.3
MAX	*	7.1	6.9	6.9	6.8	6.6	6.6	7.5	7.6	7.3	7.3	7.2	6.1
DEGR.	*	280	280	280	280	280	280	80	80	80	80	80	80

THE HIGHEST CONCENTRATION OF 9.00 PPM OCCURRED AT RECEPTOR REC1.